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UPDATE ON F–35 PROGRAM ACCOMPLISHMENTS, ISSUES, AND RISKS

JOINT HEARING

BEFORE THE

SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

MEETING JOINTLY WITH

SUBCOMMITTEE ON READINESS

OF THE

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UPDATE ON F–35 PROGRAM ACCOMPLISHMENTS, ISSUES, AND RISKS

HOUSE OF REPRESENTATIVES,
COMMITTEE ON ARMED SERVICES,
SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES,
MEETING JOINTLY WITH THE SUBCOMMITTEE ON READINESS,
Washington, DC, Thursday, April 22, 2021.

The subcommittee met, pursuant to call, at 9:31 a.m., in room 2118, Rayburn House Office Building, Hon. Donald Norcross (chairman of the Subcommittee on Tactical Air and Land Forces) presiding.

OPENING STATEMENT OF HON. DONALD NORCROSS, A REPRESENTATIVE FROM NEW JERSEY, CHAIRMAN, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Mr. NORCROSS. I would like to bring this hearing to order. And I welcome everyone to our first joint hybrid hearing of the 117th Congress between Readiness and Tactical Air and Land. I would like to welcome my colleagues, the chairman of Readiness, Chairman Garamendi, my ranking member from Missouri, Mrs. Hartzler, and ranking member for Readiness, Doug Lamborn. Good to have you here.

This hearing is focused on the Department's most expensive, complex [program] in the history of our country, the F–35 Strike Fighter.

I would like to welcome members who are joining us today, joining the hearing remotely. Members who are participating remotely must be visible on screen for the purpose of identification, establishing and maintaining a quorum, participating in proceedings, and voting.

Remote attending members must continue to use the software platform video function the entire time while in attendance, unless they are experiencing connectivity issues or other technical problems that render them unable to participate on camera. If a member experiences technical difficulties, they should contact the committee staff for assistance.

Video of members' participation will be broadcast in the room, as you see, via the television sets and internet feeds. Members participating remotely must seek recognition verbally, and they are asked to mute their microphones when they are not speaking.

Remote members may leave and rejoin the proceedings. However, if a remote member departs our hearing for a short while for reasons other than joining a different proceeding, they should leave the video function on. If members will be absent for a significant

period or to depart to join a different proceeding, they should exit the platform entirely and rejoin it when they return.

Members may use the software platform's chat feature to communicate with staff regarding only technical or logistic issue supports. I have designated a committee staff member to, if necessary, mute unrecognized members' microphones to cancel any inadvertent background noise that may disrupt the proceedings.

And, finally, all members, staff, and attendees in the hearing room, and the chair reminds everyone that they were required to observe standards of courtesy and decorum during the committee proceedings. This requirement includes the responsibility to protect public safety and health, particularly, during the pandemic. Members, staff, attendees are required to wear masks at all times in the hearing room without exception.

Members who are attending this proceeding in person will not be recognized unless they are wearing a mask. The recognition will be withdrawn if a member removes his or her mask while speaking. The chair expects all members, staff, attendees to adhere to this requirement as a sign of respect for health and safety and the well-being of others. The chair views the failure to wear a mask as a serious breach of decorum. With that, I would like to give my opening statement.

Today, we have two panels of witnesses testifying, and I welcome and want to thank them for being on the panels, and those witnesses for taking time to come here to discuss the accomplishment, issues, and certainly, the risk of the program.

We are going to hear from leaders from the Department of Defense and two of the industry's prime contractors as well as GAO, the Government Accounting Office, serving as our independent agencies, helping us to evaluate and—excuse me, evaluate production and sustainment of this challenging program. Please note GAO witnesses will be in both panels.

This October will mark the 20th anniversary of the start of the F–35 development. Two decades. And we still find the program struggling with risky, highly concurrent acquisition decisions made by past program leaders. The F–35 has been plagued throughout with unforeseen increase of development, production, and its maintenance and sustainment activities. Recent achievements of the aircraft are reassuring, the cost below $80 million. And that certainly is appreciated. And that is for the A frame. The program, certainly, has also failed to achieve full-rate production as planned, and still finds itself in low-rate production delivering less than the warfighter requirements.

The Technical Refresh 3, or as we know the TR3 and Block 4 combat capability F–35 is still at least 5 years away before declaring full operational capabilities. That is a quarter century to get there. And according to plan, we certainly find that based on recent developments that we expect that to slip, also.

My current skepticism is driven by recent media reporting that the completion of the Joint Simulation Environment testing supporting initiative test and evaluation activities may not be completed until the end of 2022, which is a delay of more than 3 years beyond the plan.

Also, after a little bit more than 2 years into development, our understanding is that TR3 hardware supporting Block 4 capabilities is approximately 4 to 5 months behind schedule and likely to be near $450 million over its planned budget.

Additionally, Block 4 software development is on shaky ground because Block 3F software, which is the foundation for Block 4, is a multiyear patchwork of inefficient and poorly designed software code that has been rushed to preserve the program schedule without undergoing the rigorous and full testing to find and fix the deficiencies prior to fielding. And this is resulting in significant software issues at the time when it is discovered in the field.

Knowing that Block 4 capability is a significant leap, and it is, those combat capabilities and mission systems integration complexity, but we are very concerned that the program will be unable to maintain its projected pace of Block 4 development and fielding without encountering significant software issues resulting in even further delay.

And, finally, we are very concerned about the actual and projected sustainment costs that have been deemed unaffordable by senior Air Force leaders. This question of estimated costs and affordability could result in a 47 percent reduction in the Air Force planned inventory goal of 1,763 aircraft just to remain within their budget.

I know our colleagues from Readiness will be addressing the program specific sustainment concerns. But if this program continues to fail to significantly control and reduce actual and projected sustainment costs, we may need to invest in other more affordable programs and backfill an operational shortfall of potentially over 800 tactical fighters.

The Tactical Air and Land Subcommittee has been supportive of this program in the past. As we have said many times, we don't have unlimited resources. As we chase this exclusive—elusive affordability of the program, and given the overall affordability concerns that exist within the program, I would not support any requests for additional aircraft beyond what is contained in this year's President's budget request.

We have seen over the past since 2015, we have up 97 jets, which has created sustainment issue for parts and others. And we will get more into that with our questions.

But before I turn it over to Mrs. Hartzler, I think it is important for us to just take a moment and thank those workers who through a pandemic have kept this and all our programs working. They have a debt of gratitude from the people on this panel for doing what they do helping to keep our country safe. They sacrificed. And would you please relay to your workforce our appreciation for what they do. With that, I want to turn it over to our Ranking Member Vicky Hartzler.

[The prepared statement of Mr. Norcross can be found in the Appendix on page 75.]

STATEMENT OF HON. VICKY HARTZLER, A REPRESENTATIVE FROM MISSOURI, RANKING MEMBER, SUBCOMMITTEE ON TACTICAL AIR AND LAND FORCES

Mrs. HARTZLER. Thank you, Mr. Chairman. And well said. Words of appreciation for your workforce who have continued to work throughout the pandemic and produce the aircraft for our Nation, and we are grateful for that.

The F–35 is a tremendous platform that is critical to our modernization efforts. Fielding a fully mission capable F–35 will fill a serious capability gap in our fighter fleet and help keep us ahead of our adversaries. But it is also one of the largest, most expensive, and most complex acquisition programs in DOD [Department of Defense] history. And getting it done right has been a struggle for both the Department and industry.

Although progress continues to be made, I share the concerns my colleagues have expressed about capability delays, affordability issues, and readiness problems which continue to impact the program. I am particularly concerned with delays in the development of Tech Refresh 3, and the development of Block 4 capabilities. The chairman touched on this a little bit.

But as GAO [Government Accountability Office] recently found, the DOD's current timeline of 2027 to complete Block 4 upgrades is unachievable. This is troubling, because while the F–35 is currently one of the most advanced fighter aircraft on Earth, our adversaries are quickly catching up. The rapid modernization of the Chinese military, especially its anti-access/area denial capabilities, will soon challenge the F–35's relevance. Block 4 capabilities are needed as soon as possible to maintain the F–35 superiority and ensure a credible deterrent against China and our adversaries.

I look forward to hearing from our witnesses about the actions being taken to overcome the challenges associated with Tech Refresh 3 and the Block 4 upgrades, as well as how risks associated with these delays are being mitigated.

I am also concerned that after nearly two decades and over 600 aircraft acquired, we are still in the operational test and evaluation phase. The F–35 cannot move into full-rate production until the DOD completes the joint simulator environment and conducts the complex test scenarios that will validate aircraft capabilities.

According to recent reports, the simulator will not be ready until late 2022. That is over 3 years behind schedule. In the interim, DOD and the industry must work to resolve over 800 deficiencies which impact performance and safety. Our goal should be to field a fully mission capable aircraft as soon as possible. That cannot happen until we can test the aircraft against its requirements and prove to the taxpayer that it does what we need it to do.

I hope our witnesses can explain why the schedule on this important milestone continues to slip. I know my Readiness Subcommittee colleagues intend to raise a host of concerns associated with sustainment costs and reliability. I share their concerns. I look forward to that discussion with our witnesses.

But it is not all gloom and doom. The F–35 has come a long way in recent years. I applaud the DOD and industry for their progress, especially for significantly reducing flyaway costs, but we still have a long way to go. We need to overcome these remaining challenges,

and we need to do it quickly. A fully mission capable F–35 is vital to our national security.

So I want to thank all of our witnesses for being with us today, and I look forward to an open and candid discussion.

Thank you. I yield back.

Mr. NORCROSS. Thank you. To the chairman of Readiness, Mr. Garamendi.

STATEMENT OF HON. JOHN GARAMENDI, A REPRESENTATIVE FROM CALIFORNIA, CHAIRMAN, SUBCOMMITTEE ON READINESS

Mr. GARAMENDI. Thank you, Mr. Chairman.

I am going to take a deep breath and try to contain my anger at what is going on here. The F–35 is the most expensive program in the history of the Department of Defense, and the sustainment costs are expected to exceed $1.2 trillion over the life of the program. The program is over budget, it fails to deliver on promised capabilities, and its mission capability rates do not even begin to meet the service thresholds.

It seems that the case of this industry solution to many of these problems is simply to ask the taxpayers to throw money at the problem. That will not happen. The easy days of the past are over. The hard days going forward are that this issue must be resolved, and it is going to get resolved in the work of this committee this year.

So, don't expect more money. Do not expect to have more planes purchased than authorized in the President's budget. That is not going to happen. The 97 planes that were added over the last 7 years have simply created a bigger problem for the sustainment of this fleet.

The F–35 is designed to generate a high sortie rates of fully mission capable aircraft that can operate and persist inside a threat envelope of our near-peer adversaries. You have just heard the concerns of my colleagues. With 20 years into this program, and we have not achieved that goal.

The propulsion system sustainment for this aircraft is not meeting requirements. On the good-news side of the ledger, the engine's mission capable rate is higher than 94 percent. That is great. The engine's "time-on-wing" rate also exceeds requirements, and that is good.

So I then have a third—I have a hard time understanding why the Joint Program Office forecasts that a greater than one-third of the F–35 fleet will not have a serviceable engine by 2030. A full third of the aircraft will simply not have an engine.

Now, we do know that the engine repair system is not meeting capacity goals. And the recent engine power module issue resulted in nine unscheduled engine changes during the 2020 Air Force deployment. Why?

Is this the function of not having the required repair capability and capacity at our organic repair facilities?

Are we missing the right tooling for the ground support equipment? Do we need better access to technical data? The answer is yes to each and every one of those. I want to hear, fully, the an-

swers to those questions. I will tell you once again the status quo is unaffordable, it is unacceptable, and it will not continue.

Turning to aircraft availability. The mission capability rate objectives are 90 percent for the Air Force, 85 percent for the Navy, and 85 percent for the Marine Corps. Yet, we have seen a stable, nonmission capability for supply [NMCS] rate in the high teens. This NMCS rate alone makes it impossible for the services to achieve their readiness objectives. And what are we doing to address this? We are buying more planes. And the sustainment rate continues to fall.

I want to hear from the witnesses today, beginning with Ms. Maurer, on the health of the supply chain, the parts of the system. I want to hear about ALIS [Autonomic Logistics Information System] or ODIN [Operational Data Integrated Network]. Have we simply changed the name and maintained the same problem? Our problems are a function of not spending—are our problems a function of not spending enough money on spare parts and repair capability?

Twenty years into this, and we still have not figured out how to maintain the planes. What the hell is that all about? We don't have the intelligence to understand that these planes are going to need to be maintained? And we didn't bother to set up a system to maintain them? Not in the depots? Not in the field? Come on now. This is not going to continue.

The Joint Program Office briefed me on the readiness rates of the recent Air Force F–35 combat deployments. That is commendable. I question, however, whether achieving high readiness in one location creates a lack of readiness somewhere else. Are we simply stealing parts from somewhere so we can keep something going otherwise? Probably so.

The supply system, could it meet the demand signals of large-scale combat operations? The answer is, no, it cannot. So the most expensive platform ever in the Department cannot sustain a large combat operation. Well, that is really brilliant.

The full mission capability rates for the F–35A, F–35B, and C are 54 percent, 15 percent, and 7 percent. Ponder that for a moment. Yeah, it can fly, maybe two-thirds of the time, but it can't do what it is supposed to do all of the time or even half of the time. And for the Marine Corps version 7 percent of the time. What is that all about? Why are we in that situation 20 years into this?

Affordability. Shall we talk about that? You have heard from my colleagues already on this. 2019 GAO report said that steady-state projected costs of the aircraft would exceed affordability constraints for each of the three services. In fact, and we are going to hear about this shortly from Ms. Maurer, the GAO reported in 2019 that the Air Force would have to reduce sustainment costs—the Air Force would have to reduce sustainment costs by 43 percent, the Marine Corps by 24 percent, and, got good news, the Navy by only 5 percent in order to afford their end-state production goals.

I understand the GAO has revisited these issues, and we will hear about it. And I would be surprised if it is any better now than it was in 2019. So we will hear about that.

We are going to need to know how we are going to drive down these costs of sustainment. Shall I repeat that? How are we going

to drive down these costs? I don't see our generals who have all the stars on their shoulders here, but they better be listening because they are going to hear this again when their turn comes up.

It is going to be some hard decisions being made on this program. We are not going to let it go any longer with a lot of happy talk. That is not going to happen. So, let's get on with it.

Ms. Maurer, thank you so very much for your report. It is not happy bedtime reading designed to put somebody to sleep. It kept me awake most of the night. If you notice that the chairman of the Readiness Committee is upset that the chairman—this chairman, not this chairman, but the previous chairman simply added to the burden of readiness by allowing the plus-up of additional aircraft, 97 aircraft added to the fleet without a sustainment plan. Increasing the burden on those planes that were supposed to be in the fleet and sustained.

We got a problem, ladies and gentlemen. And we are going to do work on it.

With that, I yield back.

[The prepared statement of Mr. Garamendi can be found in the Appendix on page 78.]

Mr. NORCROSS. Thank you. The ranking member from Readiness, Mr. Lamborn.

STATEMENT OF HON. DOUG LAMBORN, A REPRESENTATIVE FROM COLORADO, RANKING MEMBER, SUBCOMMITTEE ON READINESS

Mr. LAMBORN. Thank you, Mr. Chairman. I also want to thank the witnesses here today that are responsible for delivering, operating, and sustaining the F–35. Our Nation's adversaries are advancing their military capabilities at an alarming rate. It is more important than ever that we maintain our advantage against these peer and near-peer countries. Critical to our advantage will be the fifth-generation F–35 warfighter. While we are currently flying 400, plans include the procurement of close to 2,500.

Over the past several years, this committee has focused on both the affordability and availability of the F–35. From a readiness perspective, we must ensure that the F–35 capability is sustainable. As noted in the statements of both Pratt & Whitney and Lockheed Martin, I appreciate the efforts underway to address these challenges, but it is clear more work needs to be done by all stakeholders.

We need a ready deterrent in our F–35 platform, yet readiness metrics including mission capable and fully mission capable rates are concerning. While trending in the right direction, they are still below the services' established objectives. GAO has identified several factors and challenges to F–35 readiness, including the supply chain, the engine, and the Autonomic Logistics Information Systems (ALIS) supporting operations, planning, supply chain management, and maintenance.

Engine availability is a critical piece to this puzzle, as is the delayed standup of depot capacity. I look forward to hearing from our witnesses today how they are working together to address these challenges.

The F–35 is a vital national security investment with a planned life cycle of 66 years. I am concerned that estimated lifecycle sustainment costs continue to increase. While procuring the F–35 capability is vital to national security, we must ensure that we can afford to employ it well into the future. On this point, time is of the essence. It will be is more difficult to reduce sustainment costs as the fleet of F–35 aircraft grows.

I hope to hear today how the team is working to ensure the Navy, Marine Corps, and Army can afford to fly the F–35 and, specifically, how all stakeholders are working together to address the cost gap between projected costs and affordability constraints.

I am committed to continuing our investment into the F–35 platform and fifth-generation capability because I believe it is necessary to maintain our advantage against adversaries like China. But it is also clear that sustainment challenges exist. If our industry stakeholders don't succeed in quickly driving down the sustainment costs of the F–35, I fear critics of the program will be dealt a stronger hand in their calls to gut the program.

So I encourage all stakeholders involved—the services, the Joint Program Office, and the contractors—to get on the same page when it comes to sustainment and affordability.

Thank you to the witnesses for their time. I look forward to today's discussion.

And I yield back the balance of my time.

Mr. NORCROSS. Thank you. And just as a note, we are expecting votes somewhere 10:30 to 11 o'clock. As I understand, we have three votes. So with a little bit of luck, hopefully, we will be able to work that in between the panels.

As I mentioned, we do have two panels. And the first panel before us today includes from GAO the Director of Military Structure and Operational Issues, Ms. Diana Maurer.

We also have with us Mr. Gregory Ulmer, the Executive Vice President for Aeronautics for Lockheed Martin Corporation. When we were down viewing the facility, everything is a year ago, but it is probably 18 months now.

And Mr. Matthew Bromberg, President of the Military Engines for Pratt & Whitney.

And as I understand, Ms. Maurer, you will begin. Thank you.

STATEMENT OF DIANA MAURER, DIRECTOR, MILITARY STRUCTURE AND OPERATIONS ISSUES, GOVERNMENT ACCOUNTABILITY OFFICE

Ms. MAURER. Thank you very much. Good morning, and I am pleased to be back before both subcommittees again today to talk about GAO's work on F–35 sustainment and affordability. And my brief remarks on this panel will focus on sustainment where there have been some positive developments, but there remains a significant amount of work ahead.

First, some—some encouraging news. Mission capable and fully mission capable rates for the F–35 show continued improvement; fewer aircraft are being grounded for lack of spare parts, and average repair times have decreased. However, the program is still not meeting key goals in these areas, and significant sustainment problems remain. All 11 F–35 units we spoke with reported that supply

chain challenges continue to drag down readiness. They also struggle to maintain the aircraft because they don't have access to the necessary technical data.

ALIS, the logistics information system for the F–35, continues to be difficult to use and prone to error, creating a culture of workarounds that undermine trust in that vital system. DOD has taken some key first steps in replacing ALIS, which is encouraging. But that effort still lacks the complete strategy, there remain significant, unresolved intellectual property issues, and most notably, it will be several years before ODIN fully replaces ALIS.

We also found that units are pulling engines off planes more frequently than expected, and it is taking 70 percent longer than planned to repair key engine components. As a result, there is a repair backlog. At a current trend, if unaddressed by 2024, 1 in 8 F–35s will have been grounded for lack of engines, growing to over 40 percent by 2030.

Addressing these and other sustainment problems require close collaboration between OSD [Office of the Secretary of Defense], the Joint Program Office, the services, and the contractors. At GAO, we have 19 open recommendations to the Defense Department that if fully implemented could help with the current and future sustainment problems.

I look forward to discussing those issues and others during question and answer. Thank you very much.

[The prepared statement of Ms. Maurer can be found in the Appendix on page 80.]

Mr. NORCROSS. Thank you. Mr. Ulmer.

STATEMENT OF GREGORY M. ULMER, EXECUTIVE VICE PRESIDENT OF AERONAUTICS, LOCKHEED MARTIN

Mr. ULMER. Thank you, Chairman, good morning. Chairman Norcross, Chairman Garamendi, Ranking Member Hartzler, Ranking Member Lamborn, distinguished members of the committee, I appreciate the opportunity to testify on behalf of Lockheed Martin and our industry partners to provide you with an F–35 program update. And thank you for your interest in the program.

Please know our employees and those throughout the supply chain recognize our responsibility to deliver this weapon system to our warfighters with the most advanced capability and highest readiness levels to keep them safe as they protect our Nation. At this time, I would like to ask that my full statement be included as part of the record.

If I can leave you with three takeaways today, they are that Lockheed Martin is fully invested in reducing F–35 acquisition and lifecycle costs to keep the program affordable, maintaining a technological edge to keep the F–35 a step ahead of our peer threats, and increasing availability to ensure the fifth-gen fleet is an ever-ready deterrent for our Nation and its allies.

To begin, I would like to directly address a major area of concern from our customers: operational and sustainment costs. Lockheed Martin is applying the full weight of our talent and ingenuity to root out F–35 sustainment costs. In the last 5 years, we have invested nearly $400 million to drive sustainment costs in production

and increase readiness performance across the fleet. We must continue to reduce these costs further.

However, we cannot accomplish this alone. We must attack sustainment costs as an integrated enterprise: Lockheed Martin, Pratt & Whitney—Pratt & Whitney, industry, and the government.

In addition to addressing manpower and material cost, we believe the most effective way to achieve these results is to establish long-term sustainment partnerships that eliminate the cumbersome annual contracting process and provide more stability for investment.

We must also continue to advance the F–35's capability to keep pace with near-peer threats. When Lockheed Martin delivered Block 3F jets with the initial operational capabilities, these aircraft metrics exceeded all key performance parameters for the program.

Now, the program is focused on delivering cutting technologies and advanced capabilities as part of our modernization program to ensure that the F–35 continues to advance ahead of the threat.

There are two key pieces to modernization today. Block 4, which includes upgrades that add high advanced capabilities and weapons. And Technical Refresh 3 or TR3, the hardware that adds additional processing power, memory, and an open systems architecture to the aircraft to ensure the system can manage those Block 4 capabilities required.

TR3 has experienced cost overruns due to supplier challenges, COVID impacts, and government-directed changes. To address these challenges, we have conducted a root cause analysis and instituted a robust remediation plan that includes foregoing fee, such that it can be reinvested to buy down some of the cost overruns to date.

Block 4 has also suffered delays, and we are partnering with our customers and suppliers to ensure we remain on the critical path to deliver capabilities as our warfighters desire.

We are investing Lockheed Martin dollars along with our customer investments to advance the F–35's capabilities focused on increasing its role in joint all-domain operations. We [have] demonstrated the F–35's unparalleled ability to act as an elevated sensor, seamlessly sharing information in a networked battlespace. The F–35 is delivering capability far beyond any legacy fighter and has the systems necessary to adapt to the changing threat landscape and to continue to serve as the backbone of the U.S. fighter fleet.

On readiness, we continue to make progress on increasing the aircraft's availability. The U.S. Air Force recently returned from 18 consecutive months in the CENTCOM [U.S. Central Command] area of responsibility where they flew more than 1,300 sorties with an average mission capable rate 73.5 percent, with many periods of time operating at 80, 90, and even 100 percent mission capable rate at some points during the deployment.

While the F–35 is delivering for our customers in the field, it is also driving economic growth here at home in the United States, employing thousands of Americans in high-paying, high-technology jobs. The U.S. supply chain alone comprises more than 1,800 companies, a thousand of which are small or disadvantaged businesses.

Lockheed Martin overall has been a champion of suppliers, especially small and vulnerable businesses during the COVID–19 pandemic. In the first quarter of this year, we averaged more than $430 million weekly in accelerated payments to our supply chain partners, with a focus on small and vulnerable businesses to ensure that they could continue their important work and remain at work during the pandemic.

The F–35 demonstrates the strength of American manufacturing and preserving the critical technical workforce for our Nation. Additionally, the F–35 is providing alliance-based deterrence. By its very presence, the F–35 changes adversarial plans and behaviors. The F–35's unprecedented interoperability to support operations is transforming how coalition forces train, fight, and win. The F–35's ability to act as a sensor as well as a shooter creates an unmatched costs per effect with limited defense dollars. The ability to perform multifunction not only saves taxpayer dollars, but more importantly, saves lives.

It is a privilege to be part of the F–35 industry team. And on behalf of Lockheed Martin, I thank the members of this committee, and the men and women of our U.S. military and their families for their selfless service to our Nation.

Thank you.

[The prepared statement of Mr. Ulmer can be found in the Appendix on page 108.]

Mr. NORCROSS. Thank you. Mr. Bromberg.

STATEMENT OF MATTHEW F. BROMBERG, PRESIDENT, MILITARY ENGINES, PRATT & WHITNEY

Mr. BROMBERG. Thank you. Good morning. Chairman Garamendi, Chairman Norcross, Ranking Member Lamborn, Ranking Member Hartzler, and members of the House Armed Services Committee, I appreciate the opportunity to testify today on behalf of the 37,000 associates in Pratt & Whitney.

Since my last testimony, Pratt & Whitney has had three major accomplishments. First, despite the pandemic, we produced 159 engines in 2020, which was more than contract. And Chairman Norcross, thank you for your comments. I will share them with the team. It was a tremendous dedication by the team. And today, there is a buffer of 50 engines in final assembly.

Second, we have qualified 75 percent of the F135 parts that were sourced from Turkey, and we are on track to complete all transitions by Lot 15. Incidentally, 80 percent of those parts have been sourced in the United States, creating high-paying important aerospace jobs.

And, finally, despite a recent drop in availability, the fleet maintains mission capability above 95 percent.

At the same time, we have also had several challenges. First, engine deliveries were late to contract by on average 15 days. There are two reasons: COVID disruptions and quality findings. The COVID delays, fortunately, are largely behind us. However, we need to redouble efforts on production quality.

Due to our quality management system, these findings did not, I repeat, did not impact engine safety or reliability because they were corrected prior to delivery. However, we need to improve qual-

ity in order to improve production stability and costs. And at that end, we have funded and launched a quality improvement program that will reduce the findings by 40 percent, improving stability and reducing costs.

Second, we are seeing cost pressures across production and sustainment. Production costs with a headwind is a result of COVID and Turkey. In response to COVID, Pratt & Whitney took actions, drastic actions, to reduce structural costs. However, the timing on aerospace recovery and its impact on the supply chain is uncertain. In addition, the directed removal of Turkey from the program will increase engine costs by 3 percent.

And, lastly, sustainment costs are increasing as we catch up on sustainment spend, activate the depots, and start working more engines.

We recognize that affordability is the most pressing challenge facing the program, and we are committed, committed to reductions. Our successful "war on costs" program, which reduced engine costs by 50 percent through Lot 14, will provide a blueprint to overcome the production headwinds. And sustainment cost reduction can be and will be achieved by leveraging experience from other programs.

In particular, the F119 playbook will help us reduce engine maintenance costs by 50 percent through health monitoring, repair development, and depot productivity tasks.

Our final challenge is engine availability. While the F135 met mission capability targets, availability declined in 2020 due to a power module shortage. The primary driver was a delayed standup of depot capacity which led to a backlog of depot work. In early 2020, corrective actions were identified, projects funded, and we are making progress. We are on track to double depot output in 2021, and to double it again by 2023. At the same time, we need to do more to improve availability.

While the F–35 exceeds reliability targets, continued investment in the Component Improvement Program is critical. Second, the global F135 fleet is spared at less than half of other programs. More spares would include higher availability.

And, finally, sustainment spending has been lower than required. We need to urgently fund additional depots and spares stock.

Looking forward, it is time to fund an upgrade program. Even though the F135 is the most capable fighter engine in production, the Joint Strike Fighter is already placing a higher demand on the engine than anticipated. In the near future, air vehicle demand for power and thermal management will exceed engine capability.

To support future needs, we just completed a roadmap for a low-cost, low-risk spiral engine upgrade program. An upgrade will not only improve warfighter capability, but will also provide substantial lifecycle cost reductions.

In conclusion, we acknowledge and own the current challenges. We are confident that the actions in place will improve delivery, quality, and depot production. I see a strong enterprise alignment on addressing these challenges, and we are committed in keeping the F135 available, capable, and affordable. Thank you again for the opportunity to appear before you today. My complete testimony

has been submitted to the committee for the record, and I look forward to your questions.

[The prepared statement of Mr. Bromberg can be found in the Appendix on page 131.]

Mr. NORCROSS. Thank you for your opening statements. I am just going to ask one question to try to keep things moving, then we can come back to it. I just want to bring to your attention, I am sure you have all seen it, the Bloomberg Report, which is indicative of others. The F–35 overrun means $440 million tab—U.S. taxpayers and allied partners will be absorbing $444 million overrun for the F–35. We are talking about the TR3. These are headlines, obviously, that the public is reading along with us.

Mr. Ulmer, let's start with you. When it comes to the supplier on this particular item, who made that selection? Was that Lockheed? Was it the government?

Mr. ULMER. It was Lockheed Martin with conjunction with the government.

Mr. NORCROSS. So, we have heard from the opening statements and others some of the very real issues that is facing this. You know, the capabilities that that alone with Block 4 are the ones we all know we are going to need. What is your assessment of where that program is now given the discussions we have already had and moving forward?

Mr. ULMER. Chairman, there are really three elements, primary factors to the cost overrun. The first has to do with the performance of L3Harris. The second has to do with COVID impact. We have had some COVID impact. And the third has to do post-contract award. We had some required technology changes to the original design content that we had to change.

In terms of addressing these issues, Lockheed Martin has formed a cross-industry, as well as JPO [Joint Program Office] program office, working group team focused on performance with L3Harris, in particular.

Lockheed Martin, last summer, I defined a new organizational construct to address on TR3 implementation directly. So I removed that from the development program and put an organization around a focus on TR3 execution. We embedded Lockheed Martin subject-matter experts with L3Harris. We conducted biweekly reviews with the JPO in terms of performance—on L3Harris' performance to include a very detailed 30-, 60-, 90-day, as well as entire program integrative master plan. And we track our performance with that.

We also have senior executive reviews on the TR3. Just about a month ago, the team met with Senior Acquisition Executive Stefany to give him a status as well as Admiral Moran. So we continue to be very laser-focused on that effort to ensure that we continue to manage the program.

I would say with the implementation of these activities since last fall, we have very successfully stabilized costs as well as scheduled performance on the TR3 program.

Mr. NORCROSS. So you talked about that starting last fall. When did it come to your attention that this was going off the tracks, that the costs and scheduling? And why wasn't that arrived at in an earlier date for the correction? Because I hear what you are

doing is correcting measures, that is great. But what could you have done to identify this and fix it earlier?

Mr. ULMER. We identified this as a red program in October of 2019, and we began to implement corrective action at that time. The really significant focus occurred over last summer relative to the implementation of bringing additional subject-matter expertise beyond L3Harris' capabilities and subject-matter expertise.

Mr. NORCROSS. Are you comfortable with those corrective measures? Would you be able to address this moving forward?

Mr. ULMER. Yes, Chairman. The fact that we have seen stability in terms of performance since December timeframe, in terms of costs, schedule, and performance, and we are meeting our programmatic milestones on the program, I am comfortable with where we are at on the program today.

Mr. NORCROSS. Obviously, we have quite a long way to go. And this is so significant from what we need in warfighter. At this level, we can't discuss it. But I want to turn it over to our Ranking Member Vicky Hartzler for questions. Thanks.

Mrs. HARTZLER. Thank you. Ms. Maurer, you talked about you have several recommendations in your report to help with sustainment. Could you just go over some of those and summarize those—what you recommend? And give an assessment of based on what you are aware of, the changes that Lockheed Martin and Pratt & Whitney have made, are they progressing along those, have they accepted those recommendations, or where do we still have gaps, do you think?

Ms. MAURER. Sure. Thank you. Yes, so we have a number of open recommendations to the Department of Defense on a number of different fronts on sustainment issues. I would like to highlight just a couple of those that we have flagged as being priority recommendations for the Department.

Mrs. HARTZLER. Thank you.

Ms. MAURER. Like one of the first things that is of primary importance when you are talking about ALIS and their transition to ODIN is having performance measures in place both for ALIS and its eventual replacement, knowing when it is actually achieving success.

That will help a problem that we have heard about for years, that ALIS is getting better, but it never seems to be good enough. Well, you need to have some measure of success. So that is important.

Mrs. HARTZLER. So have they implemented those measures yet? Did they have performance measures in place yet?

Ms. MAURER. They do not have those performance measures for ALIS. They are starting to put them into place for ODIN. So that is encouraging.

Mrs. HARTZLER. Okay.

Ms. MAURER. Another recommendation I would highlight is the importance of developing an intellectual property strategy, and a more—which would include the Department gaining an understanding of what technical data it has access to and what technical data it feels it needs to successfully sustain the system. This is a recommendation that dates back to 2014. They have still not implemented it. We think it is vitally important to many different as-

pects of the sustainment enterprise, not just ALIS and ODIN, but other aspects as well.

Mrs. HARTZLER. Okay.

Ms. MAURER. And a third one I would highlight is defining a clear strategy for managing the overall supply chain. We have seen progress on this. Since we recommended this back in 2019, there is a business case analysis under way in the Joint Program Office. It has not been fully implemented. We think that is vital, because we need to have a fully effective and truly global supply chain to support what our warfighters need as well as what our allies need who are part of this program as well.

Mrs. HARTZLER. Great. Thank you.

Mr. Bromberg, I know you are working really hard to try to address some issues with the engines. And could you explain a little bit about your partnership with Tinker Air Force Base Depot and how that works with the F–35 engine, what is driving some of the recent delays in the engine maintenance, and what steps you are taking to try to stand up this issue as well as the timeline that you see going forward to address those repair issues?

Mr. BROMBERG. Yes, ma'am. All good questions. So with Tinker, we have a public-private partnership. We have a long history, and we have multiple programs where that partnership is different.

For the F135, Pratt & Whitney is the propulsion integrator. We provide plans and forecasts, we provide support equipment, we provide technical data, and subject-matter expertise training. The heavy maintenance center provides the floor space, they hire the technicians, they train them, and they deploy them to the work. And, of course, the Joint Program Office funds both of us separately. So that relationship is working. I, General Kirkland, General Fick, we are committed to improve that interconnectivity, those touch points so that we have no gaps and no handoffs. And I think that we have made tremendous progress in light of the power module change, which I will get into, at improving that.

We are leaning in as well, Congresswoman. Over the past 3 years, we have increased the size of the Pratt & Whitney team down there by 80 percent. We are adding significant leadership and supervision, and we are going to put additional resources down there as necessary to work side by side, shoulder to shoulder with the maintainers to ensure that they have the best capability, the best tools, the best technical data to overhaul the power modules.

To your second question, what happened? It is a good question. In 2019, when I was here testifying and all the years prior, we were on a firm footing. We had mission capability rates in excess of 97 percent, the engine reliability was then and still is now exceeding specification, and the production of removals, the refurbishments down in Tinker, were keeping up with demand and turnaround time was fast.

And so as we are looking at that firm foundation, we weren't worried about Turkey exiting the program, taking a depot out of the sustainment network, and we weren't worried about sustainment spend that was being reallocated to other higher priorities in the program. In retrospect, we should have.

So what happened in 2020? Well, COVID impacted us. We lost a quarter of productivity. But we also found with a heavy con-

centration of refurbishments of engines showing up at Tinker, we weren't ready. We weren't ready with the necessary support equipment, the necessary technical data, and that caused a backlog, a traffic jam. This was recognized early in 2020. And, again, General Kirkland, General Fick, Pratt & Whitney, we addressed it very quickly with several courses of action.

Over the past 12 months, we have caught up on almost all the support we have acquired to support every engine down there. There is a few items I have to deliver by June. We have added an engineering team there to provide all the technical knowledge necessary for them to continue working. We have put over 2,000 hours of training down to the Tinker team.

We will put another 3,000 hours by the end of the year. And we are moving more and more people down there to assist in the maturing and development of the floor space. And we are starting to see the benefits.

In the first quarter of 2021, output was twice what it was last year. And we predict by the end of this year, we will have twice the amount of output out of Tinker as we did in 2020, and it will double again in 2023.

So we are confident we are on the road to recover. It will take a few years to clear that backlog, but we are going to maintain mission capability rates of 95 percent. We are going to improve the productivity of the heavy maintenance center, and we are going to expand the depot with all these lesson learning—these lessons.

Mrs. HARTZLER. Just real quickly, you said you had the problem—or you didn't have the technical data. Have you gotten that now?

Mr. BROMBERG. Yes, ma'am, the technical data is there. It is always a moving target——

Mrs. HARTZLER. Okay.

Mr. BROMBERG [continuing]. Because as you learn more about the engine, you are always developing new technical data. But they have the technical data that is there.

Mrs. HARTZLER. Okay.

Mr. BROMBERG. The equipment and data that was holding us up in 2020 is not holding us up today.

Mrs. HARTZLER. Gotcha. Thank you. My time is up. Thank you. I yield back.

Mr. NORCROSS. Chairman Garamendi.

Mr. GARAMENDI. There are so many things that are screwed up here that it is hard to find a focus. It seems to be no single answer. I want to go into ALIS and ODIN in more detail. The information we received is that this transition is a neat name change, but that it is not actually working. Who is responsible here? Is this the responsibility of Lockheed Martin, Mr. Ulmer?

Mr. ULMER. Chairman Garamendi, the ALIS to ODIN transition is being run and integrated through the Joint Program Office. Lockheed Martin is not responsible for the development or integration of the ODIN system. We are responsible for supporting, as a member, in support of the Joint Program Office. In particular, we were asked to build a new base station, so think a new processor for the ODIN system. We achieved that milestone last September.

There was a congressional requirement to meet that delivery, and we were very successful in that regard. So we were able to reduce, for example, the weight of the ALIS system to the new ODIN system by about 70 percent. We were also able to improve the efficiency based on new processing power of the new computer by about twice. And then from a footprint perspective, we were able to reduce about 90 percent of the footprint requirement. That is just the hardware aspect of ODIN. Then the intent would be to load the new software architecture in programs, applications on top of that new hardware.

And Lockheed Martin is not responsible for the development or the integration of that. That is being run through the Joint Program Office.

Mr. GARAMENDI. So you got rid of the refrigerator and brought in a suitcase?

Mr. ULMER. Yes, sir.

Mr. GARAMENDI. And we appreciate that. It is a piece of the puzzle. I will ask the Joint Program Office about their piece of it. What role does Pratt & Whitney have in the transition to ALIS to ODIN?

Mr. BROMBERG. Yes, sir. We live today the engine health monitoring and logistics inside ALIS. We will live tomorrow inside ODIN. We have developed a statement of work necessary to transition the capabilities that we need from ALIS into ODIN. We will finalize that contract this year and work side by side with Lockheed Martin and the Joint Program Office to conduct the transition.

Mr. GARAMENDI. Thank you. In your testimony and in the GAO report, the supply chain is a constant piece of the questions. In addition to what was just answered with regard to the question that Mrs. Hartzler brought to us, the supply chain is not only a system, but it is also the bits, parts, pieces that go into it. Some of that is for the manufacturing of the airplane. The rest—some of it is also for the sustainment. I want to talk about the sustainment side of this supply chain. Specifically, are there sufficient parts, pieces, and other equipment—not equipment, parts and pieces available on a timely basis for the sustainment and the repair of the various—of the platforms?

Mr. ULMER. Chairman, I will take a shot at answering that on behalf of the enterprise. It is not a simple response. There is many elements relative to sustainment for the platform. From a spares, there is a capacity issue. We have not—the enterprise has not, for example, for organic depot standup for the spares and repairs of material, the program early in the development days kind of slowed that process down. And we were not going to stand up the depot organic repair capability until about the 2030 timeframe.

We as an enterprise decided about 3 or 4 years ago to accelerate that. And today we are on a path in support of that acceleration. So today we have stood up 32 of 68 depots, planned depots for F–35. And by the end of 2024—so accelerating 6 years—we will have stood up all 68 depots.

So that helps from a repair capacity. From a spare capacity, we need to continue as an enterprise both organic, OEM [original equipment manufacturer] support, as well as international content

support to support the demands of the fleet in terms of the quantities to support the fleet.

Mr. GARAMENDI. Mr. Bromberg.

Mr. BROMBERG. Yes, sir. So I can break it down in a similar fashion that Mr. Ulmer did. In terms of the parts that we use to refurbish the engines, we have plenty of stock on the shelf today. There are no part shortages that are holding up the power modules. However, we have to be diligent about stocking ahead of need so I can clear this traffic jam and prevent another one from occurring down the line. That is a priority.

Second, we support equipment. And as I indicated, we were behind support equipment in early 2020. We are right on track where we need to be now. And we have ordered $200 million of support equipment ahead of contract. So when the contract comes, we are ready to deliver it to the heavy maintenance center and the other depots around the world.

And as Mr. Ulmer said, repair development, we are accelerating that as we speak. We have developed over 250 critical depot repairs for the heavy maintenance center. And by the end of the year, we should double that.

So right now supply chain is not a concern for Pratt & Whitney, but we need to stay vigilant to ensure that we get ahead of need.

Mr. GARAMENDI. Ms. Maurer, in your report you spoke to this issue of spares and the decline—or the decline in the percentage of spares required, and now an increase in the percentage of spares. Could you elaborate on that?

Ms. MAURER. Sure. At the end of the day, the program gets what it pays for in terms of spare parts. So as currently constructed, the program pays for a non-mission capable supply rate of about 15 percent, which means they pay the contractors to provide enough spare parts to ensure that planes can fly 85 percent of the time, absent any other problems. So that sort of guarantees sort of a ceiling to any kind of availability for the aircraft.

There clearly are not enough spares to go around because 15 percent is the target. The actual numbers have been coming down. And our report is down to 16 percent, but that is still above what the goal needs to be.

There also continue to be challenges with the global aspect of this. Obviously, there are many different contractors around the globe who participate in the program. Those spares need to move seamlessly to all of the customers. That has not happened yet. There is still an open recommendation we had to the program dating back to 2019, and that continues to be a challenge for the program as a whole.

Mr. GARAMENDI. In your review, did you determine that the shortage of spares is one of the elements in the availability rates?

Ms. MAURER. Absolutely. That is certainly part of what goes into why you are not seeing even higher levels of mission capability, just simple lack of spare parts. Maintenance is also an issue as well.

Mr. GARAMENDI. Mr. Bromberg, in our discussion yesterday, you spoke to this issue, and you recommended a significant increase in the availability of spares. Could you elaborate?

Mr. BROMBERG. Let me provide distinction. When I answered your previous question, it was the piece, parts, spares that we use on the shelf to refurbish the engine. If we think about the entire enterprise that Ms. Maurer was just referring to, we had—Congress bought a program from an engine perspective that wanted an engine at a certain reliability. We are exceeding that today. We got to be vigilant [inaudible] and make sure we continue to exceed it. But that engine is the most reliable engine Pratt & Whitney has ever produced. It is exceeding program targets.

And then we built a sustainment infrastructure to take the power modules and refurbish them as they come in and out. We are behind. I indicated we are behind, but we will catch that. We have got our commitment as an enterprise, the Joint Program Office, the heavy maintenance center, Pratt & Whitney, we are working overtime to ramp up that learning curve.

In the middle are the spare engines required to plug the holes as an engine moves in and out of the operating theater. This program was constructed with 12 percent spare engines and modules. That is about half of what all my other engine programs were constructed. Very, very lean.

When everything is efficient, the engine's at reliability—I am going to be at capacity at Tinker here in the next couple of years—the system, if everything is running perfectly, will work. But the past couple years or so is that is a very lean spares ratio. And if we want to maintain availability from an engine perspective, we recommend that we plus-up that number spares engine at least for a period of time as we get up the learning curve. COVID, Turkey, learning curve disruptions has taught us that that is a really lean number, and we will probably not maintain the availability and readiness that we all want.

Mr. GARAMENDI. So with regard to the engine, if everything is perfect, we are okay. But my experience, perfection is not found in the human experience. And, therefore, you are recommending that we buy more engines?

Mr. BROMBERG. Yes, sir——

Mr. GARAMENDI. I——

Mr. BROMBERG [continuing]. For a period of time.

Mr. GARAMENDI [continuing]. Just one more question, Mr. Chairman, then I will yield back here.

The cost of the engines is about $12.3 million. And after 2,000 hours, the repair is about $5.1 million, and after 4,000 hours it is $7.7 million. And if we fly the plane for 8,000 hours, we will have bought that engine three times over in maintaining it. It is an interesting situation. I suppose this plane is designed to fly 8,000 hours. Is that correct, Mr. Ulmer?

Mr. ULMER. That is correct, Chairman.

Mr. GARAMENDI. So, with regard to the engine, just to maintain it over that 8,000 hours, we will have spent as much money as purchasing a new engine. Interesting relationship.

Mr. Chairman, I yield back.

Mr. NORCROSS. Thank you.

The ranking member from Readiness, Mr. Lamborn.

Mr. LAMBORN. Thank you, Mr. Chairman.

Mr. Bromberg, you mentioned the power module issue. What specifically is Pratt & Whitney doing to fix that problem, the growing repair issue problem with the power module?

Mr. BROMBERG. Yes, Congressman. So, as soon as we recognized that we had a challenge in early 2020, we started devoting tremendous resources.

First, we ordered all the support equipment that would be necessary for 2020, 2021, and beyond. So all that support equipment has been delivered to the heavy maintenance center for this year, with the exception of a few pieces that will be delivered by June, and we are ordering in advance of the need for the heavy maintenance center for 2021 and beyond.

Secondly, we put a full team of engineers on the ground in Tinker, working side by side with the maintainers, so that they could help them work through engineering questions and move modules through the maintenance center.

And, finally, we have dedicated a tremendous amount of engineering resources at Pratt & Whitney to provide improved tech data, work instructions, so that they can continue to learn and produce power modules at a much faster rate.

These efforts are all now starting to show the benefit. Last year, an average engine would be work-stopped for technical data or support equipment, on average, 30 to 40 days. This year, those work-stops are down to less than 5 days. So we are making huge progress at training, maturing, and getting the power module throughput that we need.

Mr. LAMBORN. Has the expected life expectancy of the power modules problem been solved with these steps you have taken?

Mr. BROMBERG. So, just to clarify, Congressman, the reliability of the engine, the reliability of the power module, is exceeding specification. It is exceeding the requirements. It is incredibly reliable. My challenge is just to clear the backlog, the traffic jam in Tinker, which we will do side by side with the heavy maintenance center. So——

Mr. LAMBORN. Okay. Thank you.

Mr. BROMBERG. Yes.

Mr. LAMBORN. Mr. Ulmer, what is Lockheed Martin's view of the need to share intellectual property with the Department of Defense?

Mr. ULMER. We absolutely do need to share that intellectual property. Today, per the contract requirements, we provide the intellectual property and the appropriate data licensing.

Last year, we were asked to propose a proposal for provisioning and cataloging data to support on the sustainment, and we responded in response to that proposal and submitted that proposal. Awaiting the Joint Program Office response to that.

Mr. LAMBORN. So the DOD shouldn't have any complaints on this question. Is that true?

Mr. ULMER. We are providing the IP [intellectual property] and data rights per our contract requirements.

I mentioned the depot stand-up, the 32 of the 68. I know of no data or tech issues associated with that. We have been supporting that requirement to the satisfaction of the depot stand-up.

I think there are desires for additional cataloging and provisional data, and we will respond to that as an industry. Lockheed Martin does not own all the intellectual property or data rights for all of the material, and so we will continue to work with the government to support the government's requirements.

Mr. LAMBORN. And you said a minute ago "per contract" or "per contractual obligations." Was that contract poorly written in the first place? Because there have been complaints about the amount of data-sharing.

Mr. ULMER. Yeah, I think the customer desire for tech data, intellectual property data rights has changed over the life of the program, and so the requirements have changed. And I think today the government desires more access to intellectual property and data rights.

Mr. LAMBORN. And will Lockheed Martin supply that?

Mr. ULMER. Yeah, we will propose and supply that data as the contract, you know—we will contract to supply that data.

Mr. LAMBORN. Okay.

Ms. Maurer, I want to finish up by giving you the chance, now that you have heard the different give-and-take from the two industry partners here, do you have any comments on the responses that you have heard so far?

Ms. MAURER. Yeah. Thank you.

I think what you are hearing is a nice illustration of how the program actually operates, right? The Joint Program Office and the services and OSD set the construct, and the contractors execute.

There have been some problems with execution. To some extent, that is expected with any kind of system as complicated and sophisticated as the F–35. But that said, it is really—this is a government-driven program.

So a lot of the problems that we are hearing about today in terms of sustainment are really rooted in the program's inability to focus on sustainment when it should have. Now, a lot of the things we are talking about today, in terms of affordability, data rights, supply chain, should have been decided 10, 15 years ago, and they weren't. And so, with a high degree of concurrency in the program, we are now having to dig ourselves out of a very deep hole that should never have been created in the first place.

Mr. LAMBORN. Okay. Thank you.

Mr. Chairman, I yield back.

Mr. NORCROSS. Thank you.

And to the chairman of Seapower from Connecticut, Mr. Courtney.

Mr. COURTNEY. Thank you, Mr. Chairman.

And, again, just to follow up your comments earlier, back in March of 2020, when Governor Lamont in Connecticut, like all of the Governors, was ordering a shutdown, a lockdown in response to COVID, it coincided with Under Secretary Lord's designation of critical infrastructure for defense contractors, including Pratt & Whitney in Connecticut.

So those workers still had to show up even though there were big challenges with PPE [personal protective equipment], and, obviously, it was a much scarier situation in terms of just trying to even understand, you know, the threat and the production levels

that Mr. Bromberg indicated. Again, really, those workers just, you know, totally performed and did their job and really deserve everyone's, you know, appreciation.

Ms. Maurer, I just want to go back to the intellectual property issue again. On pages 9 and 10 of the GAO report, again, you talked about a survey that was done, I guess, of all the depots and different maintenance facilities, and that came back, it seemed like, still as a, sort of, number one concern.

Can you talk a little bit just in—what does that mean? I mean, in terms of not having the access to that, how does that delay things or, you know, add to cost? I mean, how does that play out?

Ms. MAURER. Sure.

So, for our most recent review, we reached out to 11 different forward-deployed units that have F–35s, and we wanted to get the perspectives of people who are working on the lines. So these were line maintainers and commanders and pilots and so forth.

One of the things we heard from them, that there was frustration in their ability to fix the airplane when something went wrong. Many times they would spot a problem, and, from their experience in working with other systems, they could kind of tinker around with things and fix other systems. With the F–35, they didn't have the technical information or sometimes even the tools to make those changes. So they had to pull components off the aircraft and ship it out to a depot, and that is where the majority of the actual substantial maintenance is being performed.

So what we are hearing from users on the front lines was that, if they had access to more technical data, access to more of the specialized equipment, they would be better able to address some of the lower-level maintenance problems. Now, we didn't get into all the technical details on that, but that sort of jives with some of the things we have heard from talking to units in the past as well.

Mr. COURTNEY. And we are seeing in, sort of, new programs coming through the Air Force that, in fact, they are restructuring the contracts to sort of have greater control, right, of the intellectual property? Is that correct?

Ms. MAURER. Yeah, we have seen that in some of the other programs. There are certainly tradeoffs with doing that. Technical data is not free.

Mr. COURTNEY. Right.

Ms. MAURER. So, as part of the contract negotiations, there would be a cost involved. So that would be something that we would want the JPO to certainly examine.

And I know that there are discussions within OSD and other parts of the Department now to bring more of the sustainment of the F–35 organic into government and take some of the responsibilities off the contractors.

Mr. COURTNEY. So what Mr. Ulmer described is sort of, you know, incremental movement, as far as, you know, dealing with this issue, again, because, as you point out, this is something you guys have been flagging since 2014.

Ms. MAURER. Yes.

Mr. COURTNEY. I mean, if you did a survey today, you know, of those frontline facilities, I mean, would they say, you know, prob-

lem solved or, at least, problem is in the process of being solved? Or is it still too, kind of, clunky in terms of what is happening?

Ms. MAURER. I think what we would hear and what we heard in the most recent review is the problem has not been solved, from their perspective. It is clunky. If they want to get information on how to fix something, they have to work, sort of, indirectly. They have to talk to someone higher in command and get to a contractor and get the information, have it fall back down.

Their desire on the front lines would be to be able to do it themselves to a greater degree. Obviously, that involves——

Mr. COURTNEY. Right.

Ms. MAURER [continuing]. Tradeoffs with contracts and money, and, you know, it is not an easy or obvious solution.

But what we are hearing from the front lines is, they would like to have more technical data and they are able to do more of the maintenance than they are currently allowed do.

Mr. COURTNEY. Well, you know, again, we heard from the opening statements and certainly the press reports that, you know, we have a challenge here that people have to work together to address. And when the President's skinny budget came over and showed that the top line for the Department as a whole is going to have certainly some downward pressure, frankly, you know, there is no other choice but, you know, people have got to sort of change in terms of how this program operates, if it is going to be at all sustainable.

I yield back.

Mr. NORCROSS. Thank you.

And virtually we have the gentleman from South Carolina, Mr. Wilson.

Mr. WILSON. Thank you, Chairman Norcross.

And we appreciate the witnesses' being here today.

And, Mr. Ulmer, how is calculating the sustainment costs of the fifth-generation fighter and its internal components different from calculating the sustainment costs of the fourth-generation aircraft? What recent improvements has Lockheed made to reduce the total cost?

Mr. ULMER. Thank you for the question, Congressman.

When we look at sustainment for the F–35, we really break it up into three elements. Lockheed Martin is responsible for about 39 percent of the O&S [operating and sustainment] costs for the airframe; the propulsion system is approximately 13 percent; and the U.S. services are the remainder.

Over the last 5 years, with the Lockheed Martin content that I am responsible for, the 39 percent I have been able to reduce by about 44 percent over the last 5 years. Our models are predicting we are going to reduce that another 40 percent in the next 5 years going forward.

There are many different aspects of how we do that, how we make that improvement. We have talked about some of them already. The sparing, Lockheed Martin has gone at risk to procure spares in front of the requirement of the contracts such that they are on the shelf when necessary.

We are also very focused on repair turnaround time for the supply that we are responsible for. So we have established perform-

ance requirements in contracts with our suppliers to get in front of those requirements. We have seen significant improvement in terms of repair span reduction and repair cost.

Also very focused on the diagnostic and prognostic systems on the aircraft. When the aircraft was originally fielded, we were getting false alarms, if you will, from the system, identifying items that needed to be removed when, in fact, they weren't. And in the probably 5 to 6, 7 years ago, that was on the order of 60 percent false alarm. We are north of 90, 95 percent of cleaning that up as well.

We have mentioned ALIS. We have had continuous improvements with quarterly releases with the ALIS system. We have seen significant accomplishment. So, for example, we have been able to—transferring one aircraft from one squadron to another used to take days. Now it takes minutes. We have seen the workload relative to the maintainers using the ALIS system and various different elements, a 40, 50, 60 percent improvement using the ALIS system.

We are also very focused on reliability and maintainability improvement. So the elements that break on the airplane, we now understand what the top offenders are—the canopy, the Digital Aperture System cameras, the wingtip lenses—and we have corrective actions in play relative to improving those items. And those items that were on the top 5, top 10 list 2 or 3 years ago are no longer on that list, as we have brought corrective action to that. And so we are continuously working to refresh that as well.

So those are the kinds of things we are bringing to the enterprise relative to reducing cost from an O&S sustainment point of view on the program.

Mr. WILSON. Hey, thank you for that update. That is very encouraging.

Additionally, Mr. Bromberg, Pratt & Whitney has challenges with on-time engine delivery. While you have achieved on-time deliveries for the end of 2020, recent quality issues will drive up delivery delay times for 2021. What are you doing to ensure on-time delivery?

Mr. BROMBERG. Yes, Congressman. As I indicated, although we did deliver the required number of contracts and engines to contract in 2020, we were not happy with 83 percent of the engines being late. Again, I compliment the team, the supply chain team, for delivering in spite of a pandemic, but we have to improve that 15-day late on average.

So we launched an investigation as to what the causes were. The causes in 2020 were COVID-related. That is largely behind us. Also, quality findings. As I indicated, those quality findings are caught and corrected inside Pratt & Whitney's factory or the suppliers, so they don't impact the field reliability or safety, but they need to be addressed.

So, starting in 2019, we created and funded a $60 million quality improvement program that was staffed and launched in 2020. And now it is going to be on a multiyear journey to attack the heavy-hitter parts, the ones that are causing us the most pain, and improve their manufacturing processes by bringing the latest Indus-

try 4.0 manufacturing, automation, and digital tools so that we can have a much more stable, higher quality production system.

That is what we launched in 2020. We are about a year into it now. We will start to see the benefits of it in late 2021 and 2022.

Mr. WILSON. Thank you very much.

I want to join with Congressman Courtney in commending your workforce. All professional.

Thank you, and I yield back.

Mr. NORCROSS. Thank you.

And now the chairman of Intel and Special Ops, Mr. Gallego from Arizona.

Mr. GALLEGO. Thank you, Mr. Chairman.

Mr. Ulmer, I understand that the F–35 has made great strides in integrating capabilities among internal DOD sensor-to-shooter systems, but I would like to know what your company has done to integrate F–35 capabilities among our allies, specifically our NATO [North Atlantic Treaty Organization] partners.

Mr. ULMER. Congressman, the F–35 comes as a system to everyone that procures the vehicle. So the systems that the Air Force procures are the same for the allied nations. So the work that we have done relative to interoperability, joint all-domain operations are inherent in our allied airplanes as well.

We have seen extremely—we receive extremely positive feedback. For example, Norway and the Italians are currently flying NATO Arctic missions with their F–35s. The response and feedback we get from those customers are the interoperability, the integration, the gathering of the data from the sensor sweep, the data fusion, is game-changing, relative to their integration.

The other thing that we are finding is, as they integrate with U.S. service forces, it is very seamless. So, as the U.S. Air Force comes and participates with the Norwegians, with the Italians, with the Israelis, very first deployments, co-deployed together, interoperable, functioning well as a unit. So we hear very strong comments in regards to that.

Mr. GALLEGO. Good. That is good to hear.

Ms. Maurer, in your testimony, you noted an improvement in the amount of time it takes these companies to retrieve parts but highlighted the fact that wait times at overseas locations were problematic.

Do these delays have a different impact on U.S. forward-deployed aircraft versus our allies, who probably have everything at the depot right near them?

Ms. MAURER. Right. So thank you for the question.

And, generally speaking, things are working much better with the spare parts provision here within the United States, as you correctly noted, that those things are being delivered on an on-time basis.

It is still a problem overseas. And that is a function of the complexity of the supply chain that the program, in partnership with Lockheed Martin, is trying to develop. They are trying to move parts across many different countries, and, because they did not take on this challenge years ago, they were late to the game in working through some of the mundane but really important issues

of customs and moving things across national boundaries. That has created delays.

I know when we were in the United Kingdom for some work a couple years ago, we heard some concerns from the Brits about their ability to obtain parts in a timely manner. We are encouraged that those numbers are coming up, but remain concerned that they are not yet meeting targets.

Mr. GALLEGO. You know, it is scary to think that, in terms of our ability to project power or deter Russia, for example, it may be, you know, a customs issue that is, you know, stopping our planes from flying because we need a widget and we can't get that widget through customs.

Like, I feel like that is something that is—you know, it is not even a hardware issue; it is just, like, a people issue, that you should have people actually focused on this to make this seamless.

Ms. MAURER. Absolutely.

And there is a related problem as well. We have an open recommendation on the spares packages that the Navy—or the Air Force and the Marine Corps use when they are deployed. They have not been properly aligned with the specific requirements of the systems that they are deploying with.

They have been making progress on doing that, but that has created some challenges for getting those units ready for operational deployments.

Mr. GALLEGO. Wow. Okay.

Thank you. I yield back.

Mr. NORCROSS. Virtually, Mr. DesJarlais.

Dr. DESJARLAIS. Thank you.

Mr. Ulmer, the F–35 modernization has been covered in detail. To bring this back to the basics, though, could you explain the current Block 3F as well as the TR3 and Block 4 development, and then also provide the importance to the warfighter that comes from increased capability of Block 4?

Mr. ULMER. Yes, Congressman.

So I have mentioned, really, two aspects of modernization. Tech Refresh 3: Think the new hardware required to host the new applications of new capabilities on the aircraft.

There are really two elements that demand the Tech Refresh to the aircraft. One is obsolescence. We no longer have the ability to procure the parts of the previous processor to support the program of record.

The second really is that increased processing power that is required relative to the new capabilities. Much like in our own lives, in terms of our smartphones, our computing devices, we continuously need to update the processing power associated with the applications that will be applied on the aircraft going forward. That really is the essence.

There are three significant components that will be brought to the airframe in regards to the Tech Refresh 3. The first is the new core mission computer or the integrated core processor for the airplane. The second is the aircraft memory unit. And the third is the panoramic cockpit display that the pilot uses to understand the sensors and the information being provided to him. Those are the three main elements from a hardware update to the airframe.

What is really interesting about that, it will not—once we get to the ability to implement that hardware on the aircraft, it will not require depot maintenance for the aircraft. The fleet field maintainers will be able to implement that hardware onto the airplane in the field.

The second element is Block 4. Think the applications that will be applied on the new hardware. Those really evolve around several elements—electronic warfare, comm/nav [communiciations/navigation] communication on the airframe, weapons systems on the airframe, increased data fusion on the airframe. So those are really the key core capabilities that will be brought with new application that will be hosted on the new TR3 hardware.

Dr. DESJARLAIS. Okay.

Now, much has been made about the challenges within the F–35 program, but little has been offered about the jet's performance in the air. How has the F–35 performed in live training exercises compared to other fighters? And what are the pilots saying?

Mr. ULMER. Chairman, we hear very strong comments in support of the F–35, comments such as "game-changing," "quarterback," "incredible situational awareness relative to the battlefield," "increasing knowledge relative to the threat environment that the aircraft operates in." Not only to the benefit of an individual F–35, but the information that a single F–35 gathers is shared across air, land, and sea aspects so that they can see what the F–35 can see. So it really does help situational awareness, battlespace management. It really provides an advantage.

In particular, we hear from our international partners, the interoperability aspects of the program. The fact that one nation can fly alongside of another coherently, very successfully, and interoperable, really provide an effect to the warfighter.

The other thing that we learned from the F–35, it really helps the fourth generation as well. It is not just the fifth-gen assets. So, because of the data sensing, the data fusion, the understanding of the battlespace awareness, the airplane really does help inform other members of the, I will say, package going into a situation. It informs them, you can operate freely in this space; you need to be in regards to this threat over here. It really does help situational awareness not only for the F–35 but everyone else around them.

Dr. DESJARLAIS. All right. Well, I appreciate your testimony today.

And, Mr. Chairman, I yield back.

Mr. GARAMENDI [presiding]. I thank you, Mr. DesJarlais.

As you noticed, we are now voting, and Chairman Norcross has gone to vote. And so we are going to cycle in and out. I am going to announce the next three members to ask questions: Mr. Brown, Mr. Bergman, and Ms. Sherrill.

Mr. Brown, you are virtual, so if you would take the floor.

Mr. BROWN. Thank you, Mr. Chairman.

And my question is for Mr. Ulmer.

We have heard a little bit about depot maintenance capacity today. It is my understanding, I think we all understand, that the Department is behind in standing up an organic depot maintenance facility for the F–35.

Can you just tell us what Lockheed is doing on the repair side to help stand up the depots more quickly and when we will complete stand-up of all the depot repair lines?

Mr. ULMER. Yes, Congressman.

Lockheed Martin, in terms of the depot stand-up, we have accelerated the stand-up. I mentioned earlier, our original plan was to stand up the 68 depots in support of organic F–35 support into 2030. We are now accelerating that to have all 68 depots stood up by the end of 2024.

As we stand up those depots, the activities we undertake to help those really are information we have talked about: providing the technical data, the material required, the lay-in material required. We also inform the depots. We take subject-matter experts and work with them shoulder to shoulder to help them understand as they begin the repair.

We also work with our industry sub-tier suppliers as they will support different elements of depot stand-up. We bring them into the equation. We ask them also to provide the tech data, the subject-matter expertise, initial throughput support to ensure that the depot has the ability to take the technical wherewithal and the resources to execute that work.

Mr. BROWN. Thank you.

Mr. Bromberg, I have a question for you. It is regarding the allocation of funding for modernization and sustainment and the allocation between the air vehicle and the propulsion system. And, you know, how would you describe it? Is it sufficient? Does it enable the kinds of upgrades that need to occur in the propulsion system, or are we sort of ignoring or neglecting the propulsion system as we prioritize the air vehicle?

Mr. BROMBERG. Yeah. Thank you, Congressman, for the question.

You know, as the demands of the airframe and the tactics have evolved, fortunately the engine has been able to support it. However, we do need to focus funding on upgrading the propulsion system.

Now, with the Joint Program Office and spending some Pratt & Whitney money over the past few years, we developed a roadmap that was submitted in March that will enable us to provide more power, more thermal management, better fuel burn, and enhanced thrust out of the existing F135. But that program is not funded.

My concern, Congressman, to your point, is, if we don't launch that program, then we won't have the engine ready to support the Block 4.3 upgrades that are in front of us.

Again, we have a path to do it. We can upgrade the F135 in a manner that maintains the unit cost we are at today, that supports the sustainment cost reduction, that will provide a module upgrade that can go right into the power module, the heart of the engine. We can insert it in production. We can insert it in sustainment. We can maintain the variant commonality and the partner commonality that this engine has supported.

So we have a plan. We do need to get it funded so that we are ready for the need.

Mr. BROWN. Thank you.

And my last question, for Ms. Maurer.

You have discussed, and others have, the need to share that technical data. Mr. Ulmer mentioned it as part of what they are doing to assist in standing up depot maintenance capacity. You mentioned the lack of that data at the unit maintenance level.

What specifically can or should we be doing differently to get the technical data where it needs to be on time?

Ms. MAURER. Sure. So thank you for the question.

I think first and foremost is that the Department needs to develop a clear strategy for the technical data it needs, make decisions about that, and then negotiate with the contractors to obtain that technical data.

I think one of the fundamental problems that the program has faced for many years is that the program office has not developed a strategy to make strategic decisions about the level of technical data that they want.

And Mr. Ulmer is absolutely correct; the Department's interest in technical data has changed over the years. When this program was first launched 20 years ago, the idea was that everything was going to be handed over to the contractors. Since then, there has been a change in view, but the strategy has not come up to speed with where the Department is right now. So we think that it is important for them to do that.

Mr. BROWN. Thank you.

Mr. Chairman, I yield back the few seconds I have remaining.

Mr. GARAMENDI. Thank you, Mr. Brown.

We are alternating Democrat and Republican here. And, therefore, Mr. Moore is up next, and then I am going to turn to Ms. Sherrill. I see that Mr. Bergman left.

So, Mr. Moore, if you are there, you are next.

[No response.]

Mr. GARAMENDI. Well, we are going to be flexible. Mr. Moore, one more time?

[No response.]

Mr. GARAMENDI. Ms. Sherrill, your turn.

Ms. SHERRILL. Thank you, Mr. Chairman.

The first question is for Mr. Ulmer.

Could you discuss some of the modernization efforts needs of the F–35? And is there anything more that needs to be done to keep up with the improvements in armaments in order to maintain superiority?

Mr. ULMER. Congresswoman, there is quite a robust weapons system update as part of Block 4. I didn't get into the details, but there are a series of weapons. I can get that information to you. I can take that action off the record. But there is a substantial effort relative to bringing additional weapons systems on board to the aircraft.

[The information referred to can be found in the Appendix on page 192.]

Mr. ULMER. In addition, as part of Block 4, we are also allowing the ability to carry more internal weapons inside the airframe. We call it—today, it can carry six AIM [air intercept missile]—I am sorry—four AIM–120 missiles inside the aircraft in the stealth configuration. Part of the TR3 Block 4 modification will allow us to carry two additional weapons internal to the aircraft as well.

Ms. SHERRILL. Thank you.

And this is a question for both Mr. Ulmer and Mr. Bromberg, but I am happy to hear from Ms. Maurer about this issue as well.

I am concerned, of course, about the sustainability and repair issues associated with the F–35 engines and the effect those issues have on mission capability. I believe current estimates show, without some sort of mitigation effort, that increased engine issues of increased complexity combined with the lack of repair resources leads to over 40 percent of our engines that do not have serviceable engines—40 percent of our aircraft.

Further, our current rate of mission-capable aircraft are 70 percent or below on all F–35 variants, with fully mission capable aircraft available at a rate of 54 percent or below on all F–35 variants, with the F–35C hitting only about a 7 percent fully mission capable rate in 2020, according to the GAO.

So, if that rate of 30 percent or more of the aircraft being non-mission capable today is sustained, and combined with the rate of 40 percent of nonoperational due to the lack of available engines in 2030, even with significant overlap, that implies the majority of our aircraft will be nonoperational or non-mission capable by 2030.

So my question is this: What percentage of non-mission capable and non-full mission capable aircraft are due to engine issues?

Mr. BROMBERG. Do you want me to—well, I will start.

So, again, it is a great question, and it covers many elements of the entire weapons system platform.

From an engine perspective, we have maintained 95 percent mission capability. Now, we are not happy with the availability challenge we have, that there are some jets that don't have engines in it. I wake up every day concerned, if I don't have an engine in the jet, I don't get a pilot in the seat. That is not acceptable. So that is why we are working overtime.

The cause, again, of the power module availability issue is the backlog, the traffic jam at Tinker. So we have plans in place to improve it.

The numbers that you referenced, 40 percent degradation, that will not happen. The mitigation plans we put in place should keep us around 95 percent mission capability. And what we are now doing is trying to figure out how to accelerate that and how to move even faster and provide even better, higher mission capability.

And we have plans in place to do that. As I indicated, it is about accelerating depot production by putting additional depot capacity on line and probably putting some more spares in the fleet initially. So engine——

Ms. SHERRILL. And about what percentage—as we are talking about non-mission capable and non-full mission capable aircraft, what percentage are due to engine issues?

Mr. BROMBERG. [Inaudible] I would have to come back to you and take the mission capability numbers for the engine and relate it to the airframe numbers. I don't want to misquote that, so I will take that as an action.

Unless Ms. Maurer has that?

Ms. MAURER. I know from the data that we collected as part of our report, we were showing that this was about 4 percent, roughly, of a contributing factor.

So we would characterize this, it is definitely a problem now. It is a small "p" problem now. It will become very much a capital "P," underlined, bold problem if sufficient actions are not taken now.

We actually have an ongoing review currently that focuses specifically on the issue of engine sustainment. And we have been conducting audit work at the Joint Program Office and at Pratt & Whitney to kind of get behind some of the things that Mr. Bromberg discussed. And we will be publishing our findings on that sometime later this year.

Ms. SHERRILL. Thanks so much.

And I am running out of time, so I will submit the rest of my questions for the record.

Thank you, Mr. Chair. I yield back.

Mr. NORCROSS [presiding]. Mr. Green.

[No response.]

Mr. NORCROSS. Congresswoman Speier, you are up next.

Ms. SPEIER. Thank you, Mr. Chairman.

Let me start by asking Mr. Ulmer and Mr. Bromberg, how much money did you get from the Federal Government during the COVID crisis?

Mr. ULMER. Ma'am, this is Mr. Ulmer. We have not received any additional funds relative to COVID through the pandemic at this point.

We have been tracking issues associated with labor loss, the different activities associated with the social-distancing requirements within our manufacturing system and our workspaces, but we have not collected any additional fees at this time relative to that.

Mr. BROMBERG. And from a Pratt & Whitney perspective, we also did not take any COVID relief funds.

We did benefit from the Department of Defense program which accelerated progress payments. We took about $400 million of accelerated progress payments, and we used that to support our supply base. That was a very effective measure, as many of our suppliers were not able to withstand the pandemic impacts as well as Pratt & Whitney.

So all of those funds came into Pratt & Whitney and directly to the supply base. But we received no COVID relief funds inside Pratt & Whitney.

Ms. SPEIER. All right.

To what extent have you been able to move your manufacturing of spare parts from Turkey? Each of you, please.

Mr. ULMER. Congresswoman, this is Mr. Ulmer. So we had 817 parts that would need to be resourced out of Turkey. Today, 814 of those spare parts have completed resource. Approximately half of those have been completely resourced, so we are no longer procuring those parts.

There are a handful of parts that we reached agreement with the U.S. Government through the Joint Program Office that we will procure through the remainder of the contract that was let at the time the decision was made to remove Turkey from the program. Those are three main parts. Those parts are associated with the

landing gear and the center fuselage. Those parts will end and complete their delivery in March of 2022.

Ms. SPEIER. All right. Thank you.

Mr. Bromberg.

Mr. BROMBERG. Yes. For Pratt & Whitney, we have 188 high-technology parts that had previously been sourced in Turkey. These are some of the most critical parts in the engine. And the Turkey suppliers were high quality, low cost.

Seventy-five percent of them have been qualified in new suppliers. Most of those are domestic here in the United States. We will have the remaining 25 percent qualified by the end of the year. And by the time we deliver Lot 15 engines, which will be in mid-2022, all those parts will be sourced domestically or in this new supply base, 20 percent international, but none of them in Turkey.

Ms. SPEIER. Thank you.

Ms. Maurer, I can't begin to tell you how appreciative we are of your work on evaluating the F–35.

I was pretty alarmed by your comments that—two comments in particular: one, about the intellectual property; and, secondly, that by 2030, without some resolution of these problems, 800 engines, or 43 percent, of the F–35s will be grounded.

Tell us what we need to do to make sure that doesn't happen.

Ms. MAURER. Sure. Thank you very much, and we are always happy to support the Congress in F–35 oversight.

And I think one of the first things that you and the other Members can do is to continue to have hearings just like this one to maintain attention and maintain focus and continue the oversight of this vitally important program. This is a $1.7 trillion investment over a period of many years, so continued congressional attention is critically important.

On the engine issue, I think as I mentioned earlier, this is currently a problem. We have ongoing work to assess whether the fixes that are underway right now are going to be adequate to head off the situation that, if unaddressed, the program will face in around 2030. So stay tuned for our results of that work later on this year.

In regards to technical data, you know, we are a bit frustrated that our recommendations, going back to 2014, that the Department develop a strategic approach to its technical data needs, and then executing on that strategy, has not been implemented.

We continue to have discussions with the Joint Program Office. They are starting to make some progress on it, but they have a long way to go. Access to technical data is an important part of sustaining this vital system, and we hope that they continue to make some progress there.

Ms. SPEIER. All right. I only have 26 seconds left, so I am going to yield back. Thank you.

Mr. NORCROSS. Thank you.

Mrs. McClain.

Mrs. MCCLAIN. Thank you, Mr. Chairman.

Mr. Ulmer, I am sure you are aware, and we have talked about it today, about the numerous reports over the past few years about the cost of the F–35 program.

In my district, I want Selfridge Air National Guard Base—one of my goals is to get the F–35 wing station there. But with the delays and the cost overruns of the program, right, especially the operations and the maintenance costs, this is making it difficult to bring the program and—to talk about the program for my district.

My question is this. It is my understanding that the goal for fiscal year 2012 was for the cost per flying hour of the F–35 was about $25,000. And I wasn't here in 2012, so I am trying to get a better understanding. What is that cost now?

Mr. ULMER. Congresswoman, first of all, just a little clarity around that number. So the target was $25,000 per flight hour by 2025 in 2012 dollars. Okay? So, as the program existed in 2012, that a cost per flying hour would cost $25,000 by 2025.

Mrs. MCCLAIN. Okay.

Mr. ULMER. In 2017, for a United States Air Force A model, the cost per flying hour was about $41,300. By this 2020, we have reduced that down to $33,300, about a 20 percent decrease in terms of cost per flying hour.

And so we are very focused on continuing to support that reduction. I mentioned Lockheed Martin is responsible for about 39 percent of that, the propulsion system is 13 percent, and the remainder are O&S costs that the services—fuel, support——

Mrs. MCCLAIN. Sure.

Mr. ULMER [continuing]. Manning, et cetera.

And so the elements that we are very focused on to reduce that cost per flying hour is the availability of spares; the availability and improvement of repair turnaround time; improved diagnostics on the airframe to really help the maintainer troubleshoot and turn the aircraft faster; increased prognostics performance on the aircraft, the prediction of when parts will fail on the aircraft; as well as reliability and maintainability improvements.

So we know, we understand what the bad actors are, in terms of parts and pieces on the aircraft——

Mrs. MCCLAIN. Sure.

Mr. ULMER [continuing]. And we are constantly working to improve those. Sometimes we will resource a part to a different requirement or specification. Sometimes it is bringing slight improvements to those items. But we have seen significant improvement in terms of reliability and maintainability on the airframe as well.

So it is really a full-spectrum approach to get the cost out.

Mrs. MCCLAIN. Do we measure that in—am I looking at it the right way in terms of cost per flying hour?

Mr. ULMER. Yes, ma'am. All those kinds of elements I talked, we have discrete increments and we understand how they apply to that cost per flying hour. And then we attack those different elements.

Mrs. MCCLAIN. And we are on target to bring that down roughly by 20 percent? Is that what I heard you say?

Mr. ULMER. So, from the Lockheed Martin aspect, we see another 40 percent reduction in the next 3 to 4 years. But there are other elements across the enterprise we need to focus on.

Mrs. MCCLAIN. Okay.

Mr. ULMER. And I have the ability—you know, industry has the ability to help the maintainer, the O&S service, relative to the ac-

tions I take. And they can take actions to help me. So it really is an enterprise approach to get cost out.

Mrs. MCCLAIN. Thank you.

My second question is: According to the GAO, the sustainment cost of the program will be about $6 billion over budget in 2036. What is Lockheed Martin doing to ensure the government is not overspending on this program?

And I know you touched on it a little bit, but if we could just—if I could just get a better, simple understanding of it so I can take it back to my district and really fight to bring the program back to my district and give confidence.

Mr. ULMER. Yeah. A couple other thoughts really is: We, today, contract in annual increments relative to sustainment of the airframe. One of the things that we suggest we do as an industry and an enterprise is do more of a performance-based logistics over a longer period of time. And what that will allow for is industry to make longer, long-term investments relative to getting our suppliers, sub-tiers, ourselves, to make investments to bring reliability and maintainability improvements to the platform. That is another.

The other are the elements I talked about relative to that. Also, the ALIS/ODIN—we really need to stay focused on reducing the time it takes to use those systems, the integration. We are also focused on reducing the contractor support footprint that co-deploys with our users.

So we have seen improvement. We have more work to do with that as well. And we are very committed to getting, you know, boots on the ground off the ground. I would say, it is interesting, in the COVID world, we have learned how to do things remotely that we never knew we could before.

Mrs. MCCLAIN. Sure. There is some silver lining.

Mr. ULMER. There is a little bit.

Mrs. MCCLAIN. Thank you, sir.

Mr. NORCROSS. The gentlewoman's time has expired.

We have three more—Mr. Bergman, Mr. Bacon, and Mr. Moore—and then we are going to transition to the next panel.

But before I defer to Mr. Bergman, I have a question, just a follow-up on the Turkey question.

The cost increase, we are collectively absorbing those. But when it comes to replacements—and I know that we heard from Mr. Bromberg—from a Lockheed perspective, how many of those new sources are domestic versus foreign?

Mr. ULMER. Chairman, I will have to take that for the record. I will get you an answer as soon as I can.

Mr. NORCROSS. Okay.

[The information referred to can be found in the Appendix on page 191.]

Mr. NORCROSS. And I know we had this conversation. The parts that were already manufactured or in the system, my understanding, they are going to bleed out, be used until they are gone. Is that correct?

Mr. BROMBERG. Yes, Chairman. We are still using parts from Turkey until we shift over to Lot 15 next year. Lot 15 will have all new source parts, most of which are domestic.

Mr. NORCROSS. If you could get us a list in terms of nondomestic in particular.

Mr. BROMBERG. Yes.

[The information referred to can be found in the Appendix on page 191.]

Mr. NORCROSS. And for Mr. Ulmer, are you bleeding out the parts also? We probably could come up with a better term, but——

Mr. ULMER. Yeah. So we are resourcing the parts. Fifty percent of those parts have already been resourced. So, today, the parts that are coming in in support are resourced parts.

Mr. NORCROSS. So we bled out those, we didn't——

Mr. ULMER. Yes, sir. The remainder will be bled out or resourced between now and March of 2022. But the majority of those parts, I want to say—I think I mentioned earlier, 814 of the 817 have already been resourced. We just have to consume the parts on the shelf.

Mr. NORCROSS. Thank you for defining that.

Mr. Bergman.

Mr. BERGMAN. Thank you, Mr. Chairman.

I have just kind of one quick question, although it appeared, really, in Lieutenant General Fick's testimony, and I know he is in the next panel, but I wanted to—here is the question.

The Joint Simulation Environment [JSE]. Okay? If the Joint Simulation Environment is a pie and that pie is broken down into sections, what percentage of the pie, getting the JSE up and on line and fully functioning, what percentage of that pie sits in Lockheed's, you know, court, and what percentage of the pie sits in Pratt & Whitney's?

Mr. ULMER. From a Lockheed Martin standpoint, we are required to provide what is called the "F–35 in a Box"—thinks the simulation of the F–35 itself as a representation—within the government lab known as the Joint Simulation Environment.

I can't tell you—I don't know the other elements. It is a government-developed integrated lab——

Mr. BERGMAN. Well, the reason I asked the question is, again, it was stated here and in some of the media, is that there were some issues. As you know, we are always going to hear, as long as we are on the face of this Earth, it is a software problem, it is an integration problem, it is a—whatever. We got that. That is our future.

I guess my question is: If we are being delayed with producing F–35s because the Joint Simulation Environment is not up and running, I need to know, where do we, as the elected body here, put the oversight and the emphasis so that pie, if you will, the JSE pie, comes complete and we are moving F–35s off the line, you know, production line, onto the flight line, into the battle?

Mr. ULMER. Yeah, I am interested in that as well. I want to see the success of the Joint Simulation Environment.

I have provided that simulation for the F–35. I have also provided subject-matter expertise relative to that integration. I also provided the intellectual property and the data associated with that integration. So, the Lockheed Martin content I gave to the Joint Simulation Environment government officials such that they could help.

Mr. BERGMAN. Is that—and, again, I am not trying to pin you down to numbers here. What you provided, is that half the pie?

Mr. ULMER. No, sir. I would say it is probably less than 30, 20 percent of the pie.

Mr. BERGMAN. Okay. And how about Pratt & Whitney?

By the way, there is no—this is just more information-gathering to find out what the whole pie looks like as we make decisions here.

Mr. BROMBERG. Sir, I am going to have to come back to you on that. I don't think Pratt & Whitney's engine is holding up the Joint Simulation Environment, but let me look it up and get back to you.

[The information referred to can be found in the Appendix on page 192.]

Mr. BERGMAN. Okay. I appreciate that. Thank you for that. Because we are all in this together.

Mr. BROMBERG. Yep.

Mr. BERGMAN. Thank you.

Mr. Chairman, I yield back.

Mr. NORCROSS. Mr. Bacon.

Mr. BACON. Thank you, Mr. Chairman. I have a comment up front and then two quick questions.

But, first, I want to commend the chairman, because I think you bring the right spirit to this discussion, and I don't see that replicated in all areas. So, I appreciate how you are responding.

You know, at a time of growing contention over the viability of the program, I think it is critical that congressional oversight be based on fact, not overreaction and grandstanding. Unfortunately, the public interest and our national security are not well-served by a one-sided presentation. These attack lines are dangerous because they undermine public confidence in what is the most significant and consequential military modernization program for the United States, our allies, and freedom-loving nations around the world, and that is the F–35.

So, I publicly agree with Chairman Smith when he said that "it is the job of this committee to ensure American taxpayers are getting a fair return on their investment, and we hold government and industry accountable for results." I could not agree more. This committee has pushed the F–35 to a better spot.

But I think we have to acknowledge two sets of facts. The performance of the F–35 is unmatched. It is truly a transformational weapon and, in many aspects, is exceeding expectations. This point is universally acknowledged by pilots, maintainers, theater commanders, and our international partners who fly it. The actual 2019 contract unit flyaway cost for the F–35 have dropped below $80 million per copy and will continue to fall.

But the second point is also true: The program is not perfect. It has maturing to do. But this is what I would like to stress: Every major aircraft program in recent decades have had aspects that have struggled when it was developed, and the F–35 is no different.

But when all is said and done, the F–35 is unmatched. Its weapon system—it is the one weapon system that we have that can penetrate highly defended targets. And the F–35 is changing the balance of forces in Europe, the Middle East, and Asia.

So, we need to keep a balanced perspective. In its totality, this is a successful program with aspects that we need to improve. This is the weapon system that can penetrate the most dangerous air defenses in the world.

So, I just want us to keep this thing in perspective. We have areas we want to improve, but in many aspects this program is excelling.

So, I have two brief questions, just for my own satisfaction.

The UAE [United Arab Emirates] sale, I support it. There are Members of Congress who are pushing back on it. I think it is going to be important for deterrence in Iran and for our partners to have this capability.

But what will this do, as a secondary benefit, to the average unit cost, sustainment costs, and so forth? How will the UAE sale help us in this area?

Mr. ULMER. Congressman, at the time of the—if the acquisition goes through—and it is a government-to-government decision. I will respond to whether or not we have the ability to export and what configuration will be provided to the Emirates.

But, at that point in the program, we are actually kind of coming down the back side of peak production. And so, the benefit will be, from an economic order of quantity, it will help increase the production quantity. And purely from a supply-and-demand aspect, that will help keep the recurring costs of the aircraft down in simple terms.

I can get specific with you, I can take it for the record, relative to quantities at that point in time, their delivery profile, and the current contract deliveries, and I can I give you a more informed response in that regard.

[The information referred to can be found in the Appendix on page 192.]

Mr. BACON. Obviously, the real value is the deterrence value in the Middle East with our allies and right across the street with Iran, but I think there is a secondary benefit here. I just wanted to make that point.

Also, Mr. Ulmer or anyone else on the panel here, what feedback are you getting? We have produced over 600 aircraft, deployed them, many of our allies. What other feedback are you getting from our allies, as well as the services, in how the F–35 is performing in its operational role?

Mr. ULMER. Chairman—or, I am sorry, Congressman, we were hearing——

Mr. BACON. I like the way you think. But go ahead.

Mr. ULMER. We were hearing, to your points that you have made, it is game-changing. The advantage that the F–35 is bringing is really situational awareness to the battlespace around it. The sensor sweep that it has, the very low observable characteristics allows it to get to places that other assets can't get to.

We are finding secondary positive effects. So, the sensor sweep collects a lot of data. We have vignettes where our customers are flying operational missions, and the aircraft discovers threat or entities that we did not even know existed within the normal—actually, within or better than the current OODA [observe, orient, de-

cide, act] loop within the system for detection of those kinds of threats.

Mr. BACON. When I served in the Air Force, I was working on aspects of those sensors and those links, so it is so great to hear.

Mr. ULMER. Yeah.

Mr. BROMBERG. I——

Mr. BACON. I know we are about running out of time, so I probably have to yield back.

Mr. BROMBERG. Oh, I was just going to add, from an engine perspective——

Mr. BACON. All right.

Mr. BROMBERG [continuing]. I haven't met a pilot that didn't want more thrust out of an engine, but they all say they love the thrust and power of an F135.

The durability is unmatched. In fact, many pilots have complained that we will ingest and operate with a bird or other foreign object damage and keep flying. That keeps the pilot safe and the platform safe. So, it is fantastic performance.

The last thing we hear is from the Marine Corps. The extremely fast, capable control system allows them to focus on their mission and landing the jet while the throttle is steady.

So, we get very positive feedback. We have to stay diligent on upgrading the engine, but very positive feedback from an engine perspective.

Mr. BACON. Thank you, Mr. Chairman.

Ms. MAURER. And just real quickly, Mr. Chairman, if it is okay?

Mr. NORCROSS. Please.

Ms. MAURER. When we talk to pilots as part of our work, we hear rave reviews about the F–35 when it is flying. And that underscores the importance of making sure that the system is sustained and is done in an affordable way.

Mr. NORCROSS. Thank you.

As Chief of Staff Brown said, we would all like to drive that Ferrari every day of the week, but sometimes you have to drive the Chrysler and the Chevy, and we love them all. And there is no question this is an incredible aircraft.

The TR3 Block 4, when it comes on line, as projected now, a quarter-century has gone by since the development, and we are looking at those emerging threats that were not even envisioned when we started this program. And that is the challenge, as we all know.

With that, Mr. Moore.

Mr. MOORE. Thank you, Chairman.

I will briefly associate myself with the comments of Representatives Bergman and Bacon, first Bergman, when he said that we are all in this together—I believe that—and, second, with Representative Bacon.

Thank you, Chairman, for allowing us to have a very productive conversation today.

I am, obviously, very interested with respect to my district, Utah 1, and Hill Air Force Base, with the F–35 program. And I am committed to making this a very, very productive conversation. To the committee, to the stakeholders, our team is ready to dig in and make this a positive for our Nation. And so, I really appreciate the

concept behind, you know, let's—we have to keep this conversation productive and find the best way forward.

And the point that I will make—and I can tell from the extra comments that were given by the panelists about feedback—that is the part that I also want to be able to bring. I have interacted closely with many of the airmen and the fighter pilots at Hill Air Force Base, and this plane is unmatched. This plane can simply not be beat. When they are flying into war, they want to be on the F–35.

And so, we have sustainment and operational challenges that we need to address that will always happen when something new is brought on line. I will definitely do my part, and that is my commitment.

So, Mr. Ulmer, let me jump in with as many questions as I can get in in my time.

We have covered today the F–35 modernization in detail. Can you please explain Block 4 development and provide the importance to the warfighter that comes from increased capability of Block 4?

Mr. ULMER. Yes, Congressman.

As I mentioned, really, Block 4 sits on top of the Tech Refresh 3 relative to the hardware requirements. So, think a new mission core processor as well as a new cockpit panoramic display for the pilot and a new memory unit, which will allow the airplane to save a lot of the data and the information that it collects.

In terms of development, in terms of applications, really very centered around EW [electronic warfare], increased capability in the EW system, as well as communications, navigation, additional work on data fusion and the representation of that information not only to the crew but the other F–35s and other air, land, sea, and underwater aspects as well.

It is also very focused in terms of infil/exfil of information. So, as the data is collected, some of that data is classified. The airplane has the ability to appropriately declassify and exfil that information to other aspects.

Interoperability, improved performance in terms of interoperability.

So those are the main tenets when we look at Block 4 capability.

Mr. MOORE. Excellent.

And continuing on with that, what are the plans for retrofitting the fleet of fielded F–35s with Block 4 capability change, Block 4 cut-in slips? And if it changes with the Block 4 cut-in slips, then who foots the bill for any additional retrofitting that would be required there?

Mr. ULMER. The program still supports in-line production in Lot 15 timeframe, so think 2023. So, we are on track to deliver those aircraft with the TR3 hardware. There is no slip currently, as we speak, relative to those deliveries.

The fleet modification really is customer by customer dependent, based on their own requirement. And so, there are several different COAs [courses of action] that have been established relative to different modification updates to the TR3 and the Block 4 configuration. I believe for the United States Air Force—but I need to take this for the record to clarify. But I believe the U.S. Air Force in-

tends to update LRIP [low-rate initial production] 11 up, in terms of aircraft that will receive the modification. But I need to confirm that for the record.

[The information referred to can be found in the Appendix on page 193.]

Mr. MOORE. And that is great. I appreciate your transparency there. So, thank you.

A final quick question, Mr. Bromberg. What is being done to provide the additional overall capacity required to address recently discovered—some of the reliability issues with the F–35 engine? And any comment towards catching up with demand.

Mr. BROMBERG. Yes, Congressman. So, starting in early 2020, we focused significant efforts on improving overhaul capacity, depot capacity down in the heavy maintenance center. That includes accelerating the ordering of the tooling required to be deployed to the floor. They have everything they need absent a few tools which will be delivered by June. We are ahead of that need. That included providing the right technical support and technical data so that they can move those modules through the heavy maintenance center. They have everything they need today, and we have a team down there to support.

In addition, we are ordering tools in advance of need both with heavy maintenance center and other depots to come online. So, you are going to see progress here over the next few quarters as we double output in heavy maintenance center in 2021 and double it again in 2023.

Mr. MOORE. Excellent. Thank you very much, Chairman. I will yield back. I appreciate the moment of time.

Mr. NORCROSS. Thank you. And, unfortunately, because of the open environment we are in, we can't have that deeper discussion for all the members of these committees and, quite frankly, HAS [House Armed Services], please, be part of those classified briefings where we actually get into those challenges, those emerging threats, and what we can do.

And, obviously, Lockheed is very much part of that next generation. Again, where we started 25 years ago and where we are today, it is an incredible craft, but it is always about that next step, who is coming at that. And we appreciate each of the witnesses today for bringing their perspective to this very challenging project and look forward to working with you again.

So, Ms. Maurer, we will see you in a few minutes. From Lockheed Martin, Mr. Ulmer, again, we appreciate that. And Mr. Bromberg, and again, make sure the employees know, we appreciate it just as the warfighters do.

With that, we are going to suspend so we can clean the room and come back with the second panel.

[Recess.]

Mr. NORCROSS. We are going to call the meeting back to order. We appreciate everybody working with us with the votes and certainly with the two panels. Generally speaking, we don't try to have two panels, but with the most expensive and complex program in the history of our country, well deserved and, quite frankly, many more.

So, we now turn to our second panel of witnesses from a slightly different perspective, but certainly one that is absolutely critical for full understanding of some of those challenges. So, returning is Ms. Diana Maurer from GAO, who we heard from earlier. We also have with us Lieutenant General Eric Fick, F–35 Executive Office or PEO [Program Executive Office] as we know it. And Brigadier General David Abba, Director of Air Force F–35 integration program.

As I understand, Ms. Maurer, you are going to go first, and we will go right down the line. If you would.

STATEMENT OF DIANA MAURER, DIRECTOR, MILITARY STRUCTURE AND OPERATIONS ISSUES, GOVERNMENT ACCOUNTABILITY OFFICE

Ms. MAURER. Great. Thank you very much, Mr. Chairman. I am going to just take a couple of minutes to briefly discuss some of our main findings on F–35 sustainment affordability.

As we heard and I think everyone here fully understands from the first panel, this is an incredibly expensive program. Total lifecycle costs for sustainment are estimated to be $1.3 trillion. At the same time, it is also a very vital program. The F–35, for a number of years, has been described as the future of combat aviation with more than 400 systems fielded within the U.S. currently. You can safely say it is also the present of combat aviation in this country. So, it is critically important to get affordability and sustainment right.

One of the things that we have been tracking pretty closely over the last several years are the cost growth in those sustainment costs. And rather than the trend line going down, we are concerned that sustainment costs are continuing to grow. They are getting higher rather than lower. And that is a problem. And that is despite more than a decade of concerted efforts to bring those costs under control. There have been a number of initiatives and efforts to do that.

Which raises the issue right away of affordability. And one of the things we did in our most recent report was look at the affordability targets that each of the services have established. In other words, how much the Air Force, the Navy, and the Marine Corps can afford to spend to sustain the F–35. And what we found there was, frankly, quite troubling.

There are substantial affordability gaps between sustainment cost estimates and the amount of money the services say they can spend to sustain the F–35. In the case of the Air Force, that gap is 47 percent. So, the estimated costs are 47 percent higher than what the Air Force says it can spend.

To put that in context, if starting tomorrow Lockheed Martin and Pratt & Whitney announced that all spare parts for the program would be free for the rest of the program, that would still not be sufficient to close that gap. So, that is a substantial problem for the Air Force. There are also gaps for the Navy and the Marine Corps, but they are slightly smaller in size.

The bottom line here is that services have a plane that they cannot afford to fly the way they want to fly it, at least in the long term. There are options to close that gap, and they are all relatively difficult.

The first thing we recommended to the Department is that it take—that it continue its effort to squeeze cost savings out of the program. That is going to be challenging. This is a very mature program. There are limits to their ability to reduce sustainment costs just on cost savings alone, which led us to our second recommendations of the Department, that it take a hard look at the requirements for the program.

And that is a variety of things, including the number of flight hours, the level of readiness the services are buying through its sustainment strategy, as well as the number of planes that it plans to purchase. There are significant tradeoffs. There are significant issues involved with the services and our partners in all of those. But we think it is vital for them to take a hard look at those requirements.

Another option, of course, is to spend more. The sustainment targets were established by the services. We did not establish them in our own analysis. We used the services' numbers, so the Air Force, the Navy, and the Marines can decide to spend more on F–35 sustainment. That is going to involve billions of dollars and potentially crowd out other priorities.

Congress has a critical role in this as well, because you have the power of the purse. Ultimately, the decisions on the number of F–35s to purchase, as well as the overall congressional interest in sustainment, will help drive the overall strategy. And one of the things that we suggest in our most recent report is that Congress pay close attention to the progress the Department is making in closing these affordability gaps when you are deciding on the number of new aircraft to purchase.

Now, to be absolutely clear, GAO does not have a position on the number of F–35s that should be purchased, the level of readiness, the number of flight hours. Those are appropriately in the realm of OSD, the services, the Joint Program Office working in conjunction with Congress. But we do have an important role in providing the independent oversight to help inform those decisions.

So, the bottom line is that the F–35 is absolutely vital to the national security of our Nation. It is vitally important to a number of our allies. So, it is also vitally important that it is capable of supporting our national security goals in an affordable way.

Thank you very much, and I look forward to your questions.

[The prepared statement of Ms. Maurer can be found in the Appendix on page 80.]

Mr. NORCROSS. General Fick.

STATEMENT OF LT GEN ERIC T. FICK, USAF, PROGRAM EXECUTIVE OFFICER, F–35 JOINT PROGRAM OFFICE, OFFICE OF THE UNDER SECRETARY OF DEFENSE FOR ACQUISITION AND SUSTAINMENT

General FICK. Chairman Norcross, Chairman Garamendi, Ranking Member Hartzler, Ranking Member Lamborn, and distinguished members of the subcommittees, thank you for granting me the opportunity to discuss the status and the future of the F–35 Lightning II Program.

I am pleased to join General Abba from the Air Force Integration Office and Ms. Maurer from the GAO. The needs of our warfighting

customers are at the heart of everything, and we certainly appreciate the feedback and analysis the GAO consistently provides as it too plays a key role in our collective success. Most of all, I am honored to represent all of the men and the women of the F–35 Joint Program Office, or JPO, and the global F–35 enterprise.

Our people and partners continue to move the mission forward with passion and pride and continue to be solution driven. Because of their work, more than 625 aircraft have been delivered, 11 services in 9 countries have declared initial operational capability, and 6 services from 5 countries have conducted F–35 operational missions, bringing the world's most advanced fighter capabilities to bear from the Middle East to the Arctic.

The F–35 we have today is showing exceptional performance in operations around the globe. General Abba is better positioned to relate those positive results from recent combat operations. But I will tell you that that undeniable performance, we know that tomorrow's engagements will feature significantly evolved and ever-advancing warfighting environments and must be supported by rapid weapons development and capability delivery timelines. Consequently, we need a capable, available, and affordable F–35 to outpace those competitors and prevail on the high-end fight.

These three mandates—capability, availability, and affordability—are the focus of everything we do in the F–35 JPO, and I am eager to discuss our efforts with you today, along with the successes we have had, and the challenges we face, and our plans for meeting those challenges head-on.

First, I will talk about capability. As I mentioned before, the Block 3F capability in the field today is unmatched by any other fighter in the world. Our mandate is to preserve this warfighting edge as we continue to deliver and sustain this growing global fleet. We already know, however, that the Nation's enemies are not sitting still and in the coming years will field capabilities that will challenge today's F–35. Delivering the next-generation Block 4 capabilities is, therefore, essential.

Just over 3 years ago, we started down a new path for capability, development, and delivery. Using this new paradigm, we delivered a number of high-priority capabilities to our joint and international warfighters in addition to fixes to dozens of other deficiencies.

Our progress, however, has not been without obstacles. To enable the full Block 4 capability set, we must also deliver the underlying computational horsepower that we have been discussing today known as Technical Refresh 3 or TR3. Unfortunately, and as has been discussed, we have experienced significant TR3 hardware delays and cost increases which are actively—and are actively working with Lockheed Martin and their subcontractors to keep TR3 on track for Lot 15 insertion in 2023.

Thanks to the efforts of a joint JPO and Lockheed Martin software independent review team, I am increasingly optimistic about our ability to cost-effectively deliver the remaining Block 4 capabilities.

You will notice I use the phrase "cost-effectively." This phrase is at the heart of everything we do at the F–35 enterprise, as I see costs as our program's greatest threat. While we simultaneously focused on driving down costs across the development, production,

and sustainment areas, we understand the sustainment affordability targets present both our greatest challenge and our greatest opportunity. Sustainment cost reduction, therefore, will continue to be my highest priority.

The JPO, Lockheed Martin, and Pratt & Whitney team have made some significant strides with respect to costs per flying hour. Between 2019 and 2020, the U.S. Air Force F–35A costs per flying hour decreased 10 percent from $37,000 per flight hour to $33,300 per flight hour in base year 2012 dollars.

We are far from finished with our affordability efforts, however, but I see these actuals as movements in the right direction. Working closely with the services and our cost analysts, we understand the four biggest drivers of sustainment costs, and we are actively getting after all of them.

Finally, I would like to turn to availability. As we focus to driving costs down, we must simultaneously push the enterprise to improve F–35 mission capability rates, and even more importantly, F–35 full mission capability rates. The team continues to make progress, achieving about a 70 percent mission capable rate and 40 percent full mission capable rate across the enterprise last year, an improvement of 5 percent and 3 percent, respectively, over 2019. That is not acceptable to me. It is not good enough. I know we need to do better.

We are working closely also with the Air Force Sustainment Center and Pratt & Whitney to get after the biggest driver right now, or one of the largest drivers right now, the F135 power modules. We have put actions in place to move the needle in the right direction, and I am happy to talk to those as we get forward into my questions.

Thank you for your time, thank you for your attention, and I look forward to your questions.

[The prepared statement of General Fick can be found in the Appendix on page 149.]

Mr. NORCROSS. Thank you. General Abba.

STATEMENT OF BRIG GEN DAVID W. ABBA, USAF, DIRECTOR, F–35 INTEGRATION OFFICE, UNITED STATES AIR FORCE

General ABBA. Thank you. Chairman Norcross, Chairman Garamendi, Ranking Member Hartzler, Ranking Member Lamborn, and distinguished members of the subcommittees, thank you for the opportunity to discuss F–35 accomplishments, issues, and risks today on behalf of the United States Air Force.

I am pleased to join General Fick and Ms. Maurer on this panel. I am proud of the relationship the Air Force has with both organizations; they are valued teammates, along with our industry partners from first panel, as we all work together to maximize the success of F–35.

I would like to start by making one point as clearly as I can. The United States Air Force is absolutely committed to the F–35. The jet we have today has performed very well in operations our airmen have conducted around the globe. It is an exceptional platform that makes the joint and coalition team more lethal, survivable, and effective today, and it fills a critical capability need for the Air Force.

But we are not paying for the F–35 to perform very well. We are paying for outstanding. We need to squeeze every ounce of capability out of the F–35 to compete, deter, and win in a contested to highly contested environments that our peer competitors have already fielded and are actively improving at a rapid pace today.

The Air Force will ultimately possess and operate the world's largest F–35 fleet. As such, we will simultaneously be the program's most demanding customer and its staunchest advocate. The F–35A, due to both its warfighting capabilities and the large numbers we intend to procure, will be the cornerstone of the Air Force's fighter portfolio for decades.

Highly contested Chinese and Russian warfighting environments define the challenges we need the F–35 to solve in order for it to serve as an effective cornerstone. Consequently, we need a capable, available, and affordable F–35 to outpace these key competitors.

Note the similarity in the areas of emphasis between the United States Air Force and the program office. We must get this right, not just for the Air Force, but for all the services and nations that operate the airplane.

Starting with capability, the Block 3F F–35 we have today provides a significant capability leap over fourth-generation aircraft. F–35 from Hill Air Force Base completed successful consecutive Middle East combat deployments in October 2020.

Over 18 months, Active Duty and Reserve airmen flew roughly 20,000 combat hours, over 4,000 combat sorties, and employed just shy of 400 weapons in permissive and somewhat contested air domain environments.

But as others have testified today, peer competitors are aggressively modernizing their forces faster than we have seen in many decades. Therefore, we need Block 4, enabled by TR3, to ensure continued relevance against China and Russia.

Block 4 capabilities will increase our pilot's ability to prosecute targets, increase their survivability, enhance interoperability across the joint and coalition force, and improve sustainment. Additional schedule slips to either TR3 or Block 4 will increase risk to combat mission accomplishment and to our airmen.

Turning to availability, the Air Force needs F–35 squadrons fully mission capable across a range of expected missions to prevail against peer adversaries under contested logistics during regional lower-scale contingency operations, and to produce sufficient readiness during peacetime training.

While the Air Force faces several F–35 availability challenges, the two most urgent needs involve the F135 engine and the transition from ALIS to ODIN.

As you have heard, F135 engine issues impact Air Force readiness today. Unscheduled engine removal rates and elevated repair scope for engine power modules are outpacing depot production capacity. As of yesterday, 21 total Air Force aircraft are grounded without a serviceable engine, 15 of which are otherwise flyable.

With respect to affordability, the Air Force has a finite amount of resources to procure, operate, and sustain the F–35. The Air Force's primary affordability challenge is captured in the cost per tail per year sustainment cost metric. The draft GAO report aligns

with Air Force analysis. Costs per tail per year estimates exceed current Air Force budget projections.

If we cannot find ways to make F–35 sustainment significantly more affordable, we will be forced to make difficult decisions in coming years to meet our fighter force mix needs.

In closing, the Air Force is proud of what our airmen have accomplished with the F–35. We remain committed to the aircraft as a cornerstone of our and many other nations' combat air forces for decades to come.

As the program's most demanding customer and staunchest advocate, the Air Force is committed to working with our government and industry teammates testifying here today, and with the Congress, to ensure we get the capability, availability, and affordability we need.

Thank you again for the opportunity to provide the Air Force perspective on this important program, and I will look forward to your questions.

[The prepared statement of General Abba can be found in the Appendix on page 165.]

Mr. NORCROSS. Thank you for your statement. Just to remind everyone, we will be shifting in and out. We have one vote left. So as others are returning, so for those online also, you understand when we are going back and forth.

Affordability. We heard that affordability gap of 47 percent. When we are talking about a program that exceeds a trillion dollars, these are very real numbers. And General Fick, cost certainly is a threat to everything, but we don't have pockets loaded with money. It is all about assessing risks and program priorities. And I know you understand that. But this is something that we are struggling with. And I assume you were watching the earlier panel.

By the time TR3 and Block 4 come out, we are over a quarter century old from when we started development. The world looked very different in trying to anticipate what those threats were going to be, and challenges to this platform was a great job. But it obviously is not complete because the world changes every day.

But in terms of threat to a program and costs and affordability, this is where I want to drive down my first set of questions. Because we understand that the A model, in particular, has an operational design maturity as it relates to the number of flight hours. We understand that.

Can you explain to the committee, and I will start with you, Ms. Maurer, with an operational maturity that is virtually there, as defined by the A 35, and it is now, how is that going to impede the ability to start saving on sustainment when the model is there?

How do you make those very significant cost savings that we are looking at, given your first example, saying if you got the part for free, we are still over it? Where does that come from? How do we drive down that cost if it is this mature?

Ms. MAURER. That is an excellent question, Mr. Chairman, and it goes to the heart of some of our fundamental concerns about the program.

You know, in preparing for the testimony today, I was looking back at some of the prior hearings. And there was a hearing on the Senate side 10 years ago, almost 10 years ago this month, where

Senator John McCain asked then Under Secretary Carter a similar set of questions about driving down sustainment costs. And at that time his answer was if we don't bring down those costs, we are going to have no choice but to make very difficult decisions about the requirements.

Unfortunately, sustainment costs have actually increased during that time period. So, we are at the point of having to make some very difficult decisions with the program. And one of the things about the program now being 10 years further on down the road is that many things have been baked into the program. The sustainment approach has largely been set. So, things like ALIS and the global supply chain and decisions about the number of spare parts and the number of excess engines we are going to purchase, that has all been established, that has all been baked into the process.

So, it is going to be difficult and challenging to achieve cost savings while you are also trying to drive up mission capability rates. In the short run, you may actually have to spend more money on some of the sustainment challenges to bring that down. Which is why pursuing cost savings is a great part of any solution. We don't think that is going to be sufficient. And so, a hard look at both the requirements of the program as well as the affordability targets within each of the services need to be part of the solution.

Mr. NORCROSS. So, when you—and I will get to you, General, when I have a moment. You talked about the affordability gap just before this, the three primary areas squeeze the costs. When we are talking about a mature platform, it is a little tough, but possible requirements. Well, we have already baked in at least through Block 4. We spend more. We are cutting airplanes.

So, the first issue she brought up was squeezing costs. General Abba, how do we do that on this mature platform? And let's just focus on the A model now as not to break into some of the other challenges.

General ABBA. Yes. Mr. Chairman, we agree with the GAO's findings that we are not going to be able to reduce costs sufficiently because of the maturity issues that you talked about in order to meet our affordability targets.

Mr. NORCROSS. So, that is a big deal. When I first had the honor of joining Congress, it was fifth gen almost exclusively. You hardly heard anything else. Yet, just a few years ago you saw it shift to an additional platform, the 15 EX. If the money, quite frankly, is finite, we will have some variation, and the priorities are still there, we are facing some very big challenges.

So, Ms. Maurer, are you aware of any aircraft within the Department of Defense that has been able to reduce, significantly, those costs when it is at that mature stage of its early life?

Ms. MAURER. Well, certainly, there are ways to bring down some of the costs, but I am not aware of any program where they have been able to achieve cost reductions in the magnitude that would be necessary to close these affordability gaps.

Forty-seven percent for the Air Force. About 24 percent for the Marines and the Navy. You are not going to get these kind of reductions by just pursuing cost savings alone.

Mr. NORCROSS. And then we talked about requirements, and this leads me to a question on the propulsion system. The coatings on turbines, obviously, we know it is an issue, particularly, came into focus recently as deployment returned. Who set the requirements for the engine, General Abba, back when this engine was first put together?

General ABBA. Mr. Chairman, with all due respect, that is a question, I think, I should defer to the Joint Program Office and the PEO.

Mr. NORCROSS. Okay.

General FICK. Mr. Chairman, our program requirements were established by the JROC [Joint Requirements Oversight Council]. And there wasn't a CDD at the time. It was an operation requirements document, or an ORD, at the time that set forth the basic requirements for the performance of the system. That ORD has been refined and a CDD, capability development document, has been published as well.

The extent to which the propulsion requirement, the specifications buried within those overarching performance requirements, I don't think those were present in those documents, but I can certainly go back and verify that for the record.

[The information referred to can be found in the Appendix on page 191.]

General FICK. Relative to the coating issue itself, the F135 was designed with what is called a triplex or a three-part coating in the engines. When we discovered in 2018 that that coating was degrading in what we call a CMAS [calcium–magnesium–alumino-silicate] environment, which is a specific sandy environment, we designed a fix and actually ended up reverting to a duplex or a two-part coating like that used on legacy aircraft. That duplex coating has proven to be very effective and suffers very little degradation. So, we are confident that that fix is going to be helping us move forward.

Mr. NORCROSS. I appreciate the expansion on your answer on that. The point I am trying to make here is when those requirements were set, and I was getting to, is we made those requirements, it wasn't Pratt & Whitney.

Why wasn't the consideration—let's call it a Middle East condition, sand—not figured into that given the history of where we have been in the last half century operating? How did we miss that?

General FICK. Mr. Chairman, I don't know the answer to that question. I know that we designed the engine. We spec'd it to be compliant in certain environments. This environment was not one. I can go back and dig out the specific details associated with those environmental specifications, but——

Mr. NORCROSS. No, we have a fix. I guess I am going to the root cause when we are setting requirements for the most expensive platform in the history of our country. We have been operating in the Middle East for years. It just—we want to have absolute confidence. The smartest people are making these, and here is one that just challenges us—and this isn't directed to you, but us as—how did we miss that? And you have answered it. So, I appreciate the frankness of which you have.

I have to go vote, so we are going to go to—I am sorry? Okay. Thank you. Again, we are trying to vote and keep this in.

Mr. Wilson, you are up next. You are muted.

Mr. WILSON. Thank you very much, Chairman Don Norcross. And we were grateful for the witnesses who are here today.

In South Carolina, we are very, very supportive of F–35s. Currently, at the Beaufort Marine Corps Air Station, it has really been a real asset to people of South Carolina. That community is represented by Congresswoman Nancy Mace. And we are very pleased with the training of Americans and also pilots of the United Kingdom, the Royal Air Force, to be there at Beaufort. And so, we have a wonderful experience with F–35s.

Additionally, I am grateful, along with Congressman Jim Clyburn, to represent the capable men and women of the 169th Fighter Wing at McEntire Joint National Air Guard Base at Eastover, South Carolina. McEntire is unique in that it is located in a rural part of our State with very minimal encroachment. It is also home of the Air Force's most skilled pilots of the SEAD, and suppression of enemy air defenses mission.

And also given that Lockheed Martin has modified the F–35—and this is for General Fick—to conduct the SEAD, DEAD, [destruction] of [enemy] air defenses, how important is it to our lethality in the great power competition to ensure that the capability is transferred to the new airframe? And General Fick.

General FICK. Sir, thank you very much for your question. I think it is absolutely critical that we continue to move the program forward from a capability perspective to give our warfighting services and customers the capabilities they need to prevail in the high-end threat. The Block 3F capabilities bring tools to the table.

The Block 4 capabilities continue to accelerate our ability to dominate in that battlespace, and we do that through the addition of numerous weapons. We have 14 new weapons that are coming on board in the Block 4 capabilities set. We are enhancing the electronic warfare, we are enhancing the radar, and we are adding additional capabilities from a comm and nav and ID [identification] perspective, all of which will help us to prevail in the SEAD and DEAD missions.

Mr. WILSON. And additionally, General, how many aircraft have been delivered in operational years across the services? How many in—or our allies? What has been the feedback from pilots operating the aircraft in real-world environment?

General FICK. So, sir, 649 aircraft have been delivered to the global fleet today. The numbers are from a U.S. Air Force perspective, 373; Marine Corps perspective, 101 Bravos and 9 Charlies; and from a U.S. Navy perspective, 36 total. And if you don't mind, I would love to give your question relative to what the warfighters are seeing to my warfighting panelist to my left, Brigadier General Abba.

Mr. WILSON. Very good. Thank you.

General ABBA. Thank you, sir. From an Air Force perspective, and from what we hear in engagements with allies and partners around the world, the operator perspective is very, very clear that everybody loves the airplane right now.

Having done the operational business for a quarter of a century myself, I will tell you that we should never be concerned about operators always wanting more capability out of their weapons systems.

We should be worried if they ever stop asking for more capabilities out of their weapons systems. And in every service or nation that is transitioning from fourth-generation fleets to fifth-generation fleets, notes just the absolutely game-changing capability of what the airplane delivers today as we execute operations around the world.

But we also recognize the rapidly evolving threat environment that requires us to get to that TR3 Block 4 configuration as soon as we can.

Mr. WILSON. And then in line with that, General Abba, it is really incredible the benefit we have of sharing costs with our allies, working with Australia, Japan, Singapore, South Korea, additionally, Israel. And what has been the experience with the F–35 program in Israel?

General ABBA. Congressman, it is a great question. We have a very close military-to-military relationship with the Israelis when it comes to F–35. Israel is a foreign military sales customer for the program. But we have executed multiple interoperability exercises with the Israelis. And we have robust discussions exchanging lessons learned about operating the aircraft in combat.

Mr. WILSON. And thank you. As the grateful son of an Army Air Corps Flying Tiger of World War II and a grateful uncle of a current airman serving, I want to thank you for your service. I yield back.

Mr. GARAMENDI [presiding]. Thank you, Mr. Wilson. I guess I am next here. I always want to start taking a deep breath because the more I read, the more I hear, the angrier I become.

General Fick, it always comes back to the Joint Program Office. You are the responsible person for the entire program, for the purchase of the planes, for watching over Lockheed Martin, looking over the engine from Pratt & Whitney. You are responsible for the spares being available. You are responsible for the whole program, not only for the United States, but for all of our allies that are purchasing this.

So, I have been through hearing after hearing, and it all comes back to it is a marvelous plane—as we just heard from General Abba—we love it, if only we can keep it flying. I don't really—I don't know where to start because every single piece of this is problematic.

Every single piece. The new planes are coming in with engines that have a problem. The new planes are coming in with the inability to keep them in the air because the plane doesn't work as well and as long as it was supposed to.

So, General Fick, you are the responsible person. The Joint Program Office is the responsible party. You—I better just ask some questions, rather than tell you what you already know. You have developed a program called the Reliability and Maintaining Improvement Program.

Can you explain how that is supposed to solve the problem of maintenance and reliability?

General FICK. Yes, sir. When we look at availability, broadly, we look at availability and reliability on the platform with an eye towards improving mission capable and mission capable rates. We know there are a number of things that we have to do to move us in the right direction.

The first thing that we have to do is to keep the parts on the aircraft longer, and that is where the Reliability and Maintainability Improvement Program comes from. Our investments in R—we call that RMIP as an acronym—our investments in RMIP are designed to go after parts that are failing prematurely, or parts that have a substantial opportunity to improve their time on wing, and then to invest in them and cut them into production and cut them into spares so that we actually keep them on the aircraft longer. That is really one of the four levers we have from an availability perspective.

Mr. GARAMENDI. So, in your contract with the two principal companies, do you have the ability in that contract to hold them accountable for reducing or improving the reliability of the parts and pieces on the airplane? Do you have that power?

General FICK. So, within our annual sustainment contracts that we have let with Lockheed Martin and Pratt & Whitney right now, we have a number of incentives that are placed onto those contracts. And the incentives placed on those contracts incentivize them to deliver to us mission capability rates across the A and the B and the C model—speaking about the air vehicle right now—across the A, B, and the C model. They also incentivize what we call gross issue effectiveness, and they incentivize repair turnaround time.

So, the first half of that, the first MC [mission capable] part incentivizes them to invest prudently to keep the aircraft flying longer. The second half of that really are supply chain metrics that incentivize them to have parts ready to go when the aircraft breaks, which is really our second——

Mr. GARAMENDI. Would you describe the incentive?

General FICK. So, it is——

Mr. GARAMENDI. Let me put it this way. Do they get paid less if they don't perform? Do they get paid more if they do perform?

General FICK. They get paid less if they don't perform.

Mr. GARAMENDI. Could you please deliver to our subcommittee the specifics about how that incentive works or——

General FICK. Absolutely.

Mr. GARAMENDI [continuing]. Apparently, it doesn't work too well thus far. Perhaps, we have found in other places that while the incentives are there, they are simply not utilized. Have you withheld or reduced payments to Lockheed Martin and to Pratt & Whitney for failure to meet the metric?

General FICK. Absolutely. And we have done that across our development contracts, our production contracts, and our sustainment contracts. Each of which include what we call a performance incentive fee or PIF that is aimed to—well, to incentivize them to perform above and beyond the requirements.

Mr. GARAMENDI. Please supply the details to the committee——

General FICK. Absolutely.

Mr. GARAMENDI [continuing]. About the existing incentive program as well as the actions that you have taken.

General FICK. Yes, sir.

[The information referred to can be found in the Appendix on page 193.]

Mr. GARAMENDI. I am going to withhold further questions and turn to Mrs. Hartzler.

Mrs. HARTZLER. Great. Thank you. I appreciate that, Mr. Chairman.

I understand that the annual costs of the F–35 to sustain it is $8 to $9 million per tail depending on the variant. Can you explain what goes into that cost? Because just as an ordinary citizen looking at that, I think, how can you come up with $8 million worth of maintenance cost every year?

General FICK. Ma'am, thank you for the question, and it is a good one. Where there are four basic elements to the cost of the aircraft, of sustaining aircraft, and they include what we call sustaining support. These are the people basically that are doing the work, largely, on the flight line. Our field support are Lockheed and Pratt & Whitney field support representatives and field support engineers. In addition to what you probably heard to—referred to as ALIS administrators. These are Lockheed folks who are boots on the ground working with ALIS. That is one driver.

The second driver of sustainment costs includes our U.S. Government maintenance footprint. This is one of the things that Ms. Maurer was talking about previously. Once the design is completely baked on a program, at times it becomes challenging to be able to effectively reduce that maintenance footprint. We are working really closely with General Abba, the Air Force, the Navy, and Marine Corps looking at alternative ways to train our maintainers to help us reduce that maintenance footprint.

The second, the last two pieces are really air vehicle parts and their repair, and engine parts and their repair. In aggregate, all of those pieces when combined together form that—are kind of the four pillars of that annual sustainment cost. And those also present our greatest opportunities to go after cost, to target those specific areas in an attempt to bring costs down. Certainly, we won't make them go away, as Ms. Maurer mentioned, but we can certainly bring them down.

Mrs. HARTZLER. It seems like there is a lot of room there for improvement. I mean, how much do these parts cost? Is it really warranted? How much are these individuals paid per hour? What is their rate of production? There is just a lot of things here. So, I hope that you will continue to go after those.

I had to step out to vote, so has anyone—have you had a chance to visit about the joint simulator environment? Okay. Can you give us some insights with those problems with that, because that seems to be holding everything up moving forward. Until you all get the joint simulator ready to go, we can't really have that testing that is needed. So where are we at on that, and what is the problem?

General FICK. Ma'am, so the Joint Simulation Environment is an environment that we, the U.S. Government, decided to establish maybe about 5 years ago for the conduct of initial operational test

and evaluation. Originally, we were going to use a Lockheed Martin facility, but elected to pull that away from them and do that ourselves.

So, we have been working very, very closely with Naval Air Systems Command in Patuxent River, Maryland, to bring the Joint Simulation Environment to life over the course of the last several years.

What we have discovered is that integrating both the F–35, but as well as all of the blue and red aircraft, all of the other ground and airborne threats into that environment, along with all of the weapons that they use in numbers that are operationally representative of the theater that we are trying to synthetically create, is a very daunting problem.

It is a very challenging problem to do that integration in a way that allows us to then take open-air flight test data, bring it into that environment, and prove to ourself that in that synthetic environment, I can exactly duplicate what I would have seen in open air.

It is that verification and validation process that gives us the ability to use that for initial operational test and evaluation. But it is that rigor, that degree of integration between the weapons, the platforms, the threats, their weapons in that synthetic space that is so very challenging.

So, as we have moved forward, it has been challenges associated with that integration, compounded a little bit by COVID. Ultimately, most of the work that we are doing, we have to do in classified spaces as they work that integration and social distancing in what are typically small spaces is challenging.

So that has compounded it. But I just don't want to undersell the challenge associated with the task. It is very complex.

Mrs. HARTZLER. So how many years has it been you have been working on this now?

General FICK. Ma'am, I have been working—so I have been in the Joint Program Office, next week will be 4 years as the deputy or as the PEO, and it has been under development the entire time that I have been here. I don't know the exact date on which it switched over from the Lockheed VSim Solution to the JSE. But at least for my duration in the program office, it has been going on.

Mrs. HARTZLER. So, I had the opportunity to see some war games that was going on. And I was surprised to learn that is—a lot of it is open source. That it is something that people can buy on the shelf. That individuals, kind of like Wikipedia, actually feed into it. And then our government adds to it extra sensitive information.

But are you using any private companies in this development process that could help with some of the basics of the simulator?

General FICK. Ma'am, so we have enlisted the assistance. Shortly after the beginning of the year, we enlisted Carnegie Mellon University, Johns Hopkins University, and the Georgia Tech Research Institute to help us to assess whether the task that we are actually trying to accomplish in the JSE is even feasible. We are due to get that assessment back later this month or early next month to make sure that we are not asking for something that is impossible.

It is very easy to make things look right on the screen. It is a lot different to make sure that all of the software operational flight

programs are responding appropriately, all of the signals are processed by the radar or the radar simulator appropriately. Because it is those, really those interactions under the hood that are the things that are important with this very, very complex weapon system.

Mrs. HARTZLER. Very complex for sure. So, what will you do if the university comes back and says what you have been trying to do for 4 years is impossible?

General FICK. So, ma'am, I don't think that is going to be the case.

Mrs. HARTZLER. Okay.

General FICK. But we will—I think we would need to have a very serious conversation with the Director of Operational Test and Evaluation about whether or not he still feels that those 64 final runs in our initial operational test and evaluation program need to continue to be executed.

Mrs. HARTZLER. Great. Thank you very much. I will yield back.

Mr. NORCROSS [presiding]. Thank you. Mr. Courtney.

Mr. COURTNEY. Thank you, Mr. Chairman. General Fick, at the first panel, Ms. Maurer did a really nice job of sort of walking the members through the way the lack of access to the intellectual property and technical data sort of disrupts, you know, an efficient maintenance program out at the sites where the F–35s are.

Mr. Ulmer from Lockheed sort of described that there has been some movement, you know, in terms of the government getting, I guess, more control over that. But it sounded very sort of sporadic and ad hoc. And I think we agreed clunky was also a way to sort of describe how that is right now.

So, can you, I mean, just describe again what is the dynamic here? I mean, obviously, it seems like it is a contractual problem, right? Because you have got to almost go back in and renegotiate a proprietary right. Is that sort of what is making—because this has been the recommendation since 2014?

General FICK. Yes, sir, thank you for your question. So, certainly, this question and the problem itself has at its root the initial philosophy of the program, which was a total system performance responsibility effort led completely by Lockheed Martin.

So there are a lot of things that we didn't ask for relative to our ability to take delivery of them, that perhaps in a program that had started in a different way, we would have asked for and taken delivery of those pieces of data earlier.

And so that is not necessarily an intellectual property issue, it is a data delivery issue. And were we willing to pay and did we pay for those pieces of data.

Relative to what the users, to what our maintainers are finding on the ground at the squadron and group level, they have become accustomed to working inside a maintenance concept that has them doing more things than was designed into the F–35 maintenance concept from the beginning. The F–35 maintenance concept is one that goes what we call O to D, organizational level to the depot level, with no intermediate level between them. A lot of other programs, a lot of legacy programs go from that organizational level to an intermediate or back-shop level.

And it is at that back-shop level where many times another Air Force person or civilian would disassemble the part, repair it locally, and not actually send it back to the depot.

The decision was made within the program that we are going to go straight from O level to D level. We are not going to staff those back-shops. We are not going to put extra people there to do that work.

And so, what I sense that Ms. Maurer and her team found was that the maintainers who are maintaining the F–35, having come from other programs that use immediate-level maintenance, want to do that work.

And so, what we need to be able to do is to assess the costs and the benefit associated with doing that work. And if it is appropriate that we do that, maybe we adjust the maintenance philosophy and open up the opportunity for us to add that extra level, add those tasks, collect the data to do so to allow that to happen.

Mr. COURTNEY. So, it sounds like, then, you are not totally buying into the notion that getting, you know, greater control of that technical data necessarily is going to result in, you know, improved maintenance. Am I hearing that?

General FICK. I guess I wouldn't say it that way. What I would say is we need to study these things before we execute them. The one end of the spectrum would be that we need to purchase all of the technical data for the program, and we need to take delivery of it. And that would be a very expensive proposition. The other end of the spectrum would be just for places where we started.

Somewhere in the middle is where we need to end up, which is we get the tech data that allows us to do the things that provide the biggest bang for the buck for our maintainers. Because General Abba in the Air Force has to figure out if they would rather do that, or if they would rather do something else. Because I can't come back and ask for more money.

Mr. COURTNEY. So, I mean clearly on other subcommittees we have heard from the Air Force about the fact that platforms that came into being after F–35, you know, there is a different approach in terms of getting control of that.

So, I mean, I sort of took from that that, you know, that is sort of a de facto endorsement by the Air Force that that is a better way to run a program.

You know, I would just say this, you know, if GAO, and I think they seem to be, you know, describing something that makes a lot of sense, you know, and I tried to convey this to Mr. Ulmer, you know, we have got a problem here in terms of just the overall top line of the budget.

And people have got to start making some moves on both sides of the table to try to come up with ways to be more efficient. And this seems like it is sort of screaming out for movement, you know.

And to the extent that Congress can help with that, I think from the chairman of this committee on down, I think there is a lot of interest in terms of trying to see if there is ways we can enable that in the NDAA [National Defense Authorization Act], or wherever. So anyway, thank you for your answers.

General FICK. Yes, sir. I guess I could add, the Navy is actually also very interested in what we call intermediate-level mainte-

nance, and they have actually begun a pilot pursuing that as a Navy unique looking at their option and opportunity to do that work, given that much of their time, of course, is spent aboard ship. Right?

So, the notion of sending everything O to D on an aircraft carrier misses an opportunity to take advantage of skill sets that are present. So, the program office is currently working that with the Navy. I could see an analog if the Air Force were interested.

Mr. COURTNEY. Mr. Chairman, just really quickly. Ms. Maurer, if you have suggestions for the committee in terms of how to address this issue, I mean, I think we would be all ears.

Ms. MAURER. No, absolutely, I think this is a very important and vital issue. And one of the things we have been in discussion with the committee staff is the next review that we will be doing at GAO would be to look in-depth at the potential costs and benefits of moving more of the sustainment approach, organically, giving more responsibility to folks inside the government, and moving the needle more towards the middle as General Fick described.

Mr. NORCROSS. Thank you. Ms. Speier.

Ms. SPEIER. Thank you, Mr. Chairman. General Fick, I think the American taxpayers are asking a very simple question. We spend more money on defense than our peers and near-peers combined. And then you have a project like the F–35, 25 years in development.

I know these questions in some respects aren't fair to you because you have only been in charge for 4 years. But, the problem is the costs are extraordinary. And I think you have heard that from everybody.

Based on what has been said by Ms. Maurer from GAO, we either have to decide to build fewer planes or purchase fewer planes or reduce the number of flight hours or reduce the number of requirements. It seems like at some point we are going to have to answer that question. Have you started to think along those lines?

General FICK. Ma'am, we are absolutely working together with all of our customers, General Abba, next to me, his counterparts, the Navy, the Marine Corps. And I know that those conversations go all the way to the chiefs of staff, to the commandants, to the parliaments of each and every one of our international partners as well.

The lever that I control in the affordability conversation is cost. As I mentioned previously, there are a number of things that we can do relative to cost, and the program office is aggressively attacking each of those and working to cement those into our annual contracts.

Ms. SPEIER. All right. Thank you. I have got very limited time.

Ms. Maurer, what recommendations that you have provided over the last year or 2 years relative to the F–35 have not been complied with by the Department of Defense?

Ms. MAURER. Thank you for the question. So, we have—over the past several years, we have had a total of, I think it is 30—30 different recommendations specific to different issues associated with the sustainment. Eleven of those are closed, 19 of those are open. I think that the good news there is that we have seen in the last couple of years increased attention and focus from the Joint Pro-

gram Office as well as OSD and others to take actions to implement those recommendations. So that is encouraging.

But we are also concerned that most of them are still open. And we think that there needs to be additional progress made on some of the key recommendations around strategy for managing the supply chain and intellectual property strategy, as well as continued progress on different aspects of ALIS and ODIN development.

We also think that the new recommendations that we have in our current report about taking a look at cost-saving efforts, taking a hard look at requirements, developing an overall strategy for affordability, and then building risk into that analysis, and reporting it out to the Congress are going to be very important in the near term and in the future for continued effective oversight.

Ms. SPEIER. Thank you. Mr. Chairman, I would recommend that in the next 6 months we have another hearing and hone in, specifically, on the recommendations made by GAO that have not been followed up on so that we can track this more carefully.

General Fick, who now owns and controls the data within ALIS?

General FICK. Ma'am, the data within ALIS is owned and controlled by the U.S. Government.

Ms. SPEIER. And it will be owned and controlled by ODIN as well. I mean——

General FICK. Yes, ma'am.

Ms. SPEIER [continuing]. We will own and control ODIN. So, there was a dispute last year about the software, and that we didn't really have control of the software and had to rely on the contractor. Is that still the case?

General FICK. So the case with the ALIS software, the parts of the ALIS software that we paid for, as a government we own; the parts of the ALIS software that we did not pay for that were sourced at either Lockheed's expense or perhaps came from what were COTS [commercial off-the-shelf] elements of software, we don't own the rights for. But we do own the rights for the software that we paid for.

Ms. SPEIER. Well, but then we are hampered. Moving forward with ODIN, are we going to own everything?

General FICK. Yes, ma'am.

Ms. SPEIER. Would it be helpful if Lockheed would turn over the software that they technically own and make our movement to ODIN simpler?

General FICK. So, ma'am, I don't know if that would be helpful or not. We are actively working the transition from ALIS to ODIN. When I briefed this committee last year, I committed to a very aggressive timeline for the transition between ALIS and ODIN. And what we have learned over the course of the last year is that that transition in that amount of time, which effectively amounted to a flip of a switch, is not going to be possible.

So, as we have continued to mature the discussion and our foundational work on ODIN over the course of the last year, we have come to realize that we need to do two things. The first is we need to continue to improve the functionality of ALIS in the near term as we ensure that the ODIN structure that we put into place from a hardware perspective, from a data environment perspective, and from a software perspective is what the users need.

And so, we have moved out and developed a user agreement that helps us to navigate the relationship with all of our users relative to ODIN. And we have developed an ODIN capability needs statement that allow—that helps us to actually write down the things that we need ODIN to do and how we need them—and how we need ODIN to do it. The challenge is——

Ms. SPEIER. I think my time has expired. But let me just say, I have a couple of other questions that I am going to ask you to respond to. One in part being, I presume we are now paying for the costs of both ALIS and ODIN, and I would like to know what that is. But I will submit them for the record.

With that, I yield back, Mr. Chairman.

Mr. NORCROSS. Thank you. And your recommendation is under advisement for the timing issue of bringing them back.

John and I both have a few questions left. And we are the only two left, and Jackie.

Mr. GARAMENDI. If I might?

Ms. Speier, if you could stick around. You had two more ODIN/ALIS questions. On my time——

Mr. NORCROSS. We are going to be here.

Mr. GARAMENDI [continuing]. I would appreciate you taking up those questions, as I was going to go into that myself. So, when it comes to my time, if you can continue with the ODIN/ALIS.

Ms. SPEIER. All right.

Mr. NORCROSS. Jackie, I will defer now. You were on a roll. Continue.

Ms. SPEIER. So, if you could, General, tell us how much we are now spending maintaining these two systems.

General FICK. Okay, ma'am. So, the future cost, as we work to transition into ODIN, we intend to invest, over the course of the FYDP [Future Years Defense Program], $471 million into the combination of ALIS and ODIN as we move from one into the other.

Ms. SPEIER. And how much was ALIS costing us before?

General FICK. Ma'am, the total cost invested on ALIS over the course of the program, to include ALIS development, hardware procurement, and operations, is just over a billion dollars.

Ms. SPEIER. It is a billion dollars. And, as I understand it, it has never worked properly, and our maintainers have had to make split-second decisions as to whether or not to let the plane fly because they didn't have the logs. Is that correct?

General FICK. Ma'am, I wouldn't call them split-second decisions, but, yes, our maintainers have had to deal with errors in the way that ALIS has handled the electronic equipment logs [EELs]. We talked about that in the Oversight and Reform Committee hearing last summer.

The good news there is that we are actually seeing significant progress in how we are digesting our EELs. We have seen that the ready-for-issue rate has increased from 43 percent in February of 2020 to 84 percent in February of 2021.

One of the other things we talked about at that particular point in time was actually reducing the number of parts that require EELs. We have actually done that. We have removed 438 part numbers that formerly had EELs, and that impacted 118,000 parts across the enterprise.

So, we are actively moving the needle in the right direction, relative to the EEL question.

I would also articulate that, over the course of the last year, we have changed our philosophy relative to fielding software updates into ALIS, and we have moved from a big bang every 2 to 3 years kind of an update to a quarterly update cycle that has allowed us to interact directly with the users, figure out what is making their heads hurt, and then get after them.

Our last two releases have been very successful. But you will notice I said "quarterly" and "in the last year" and "two releases" all in the same sentence, which means that two of the quarterly releases ended up having to be combined with another because of issues we found in development.

So we are being very careful and judicious about how we field this new software to the field, how we push this new software to the field, to make sure we don't adversely impact operations, while still improving the usability of ALIS as we make way to transition into ODIN.

Hopefully that made sense.

Ms. SPEIER. All right. I think it did.

General Fick, back in July of last year, before the Oversight Committee—you referenced this earlier—you said that, beginning in 2021, the contracted requirement for parts ready to issue will be 99 percent. That is a quote. And you just referred to the fact that that was ambitious and that you weren't able to do that.

When do you think you will be in a position to say that 99 percent of the parts are ready to issue?

General FICK. Ma'am, my team is negotiating the 2021 to 2023 annual sustainment contract with Lockheed right now. Candidly, I was hopeful that I would able to announce to the committee today that we had reached a handshake agreement, but we have not.

I know that the RFI [ready for issue] parts percentage requirement as part of the contract incentives in that contract was set to 99 percent. I need to follow up with you and let you know when we anticipate that happening.

I will tell you that, over the course of the last year—I gave you the two endpoints. I gave you February of 2020 and I gave you February of 2021. And we have seen dramatic improvement, but what we have also noticed is that we also see dramatic swings month over month as we assess the data that we get back from the field, which means that what is happening is, as new suppliers or different suppliers ship parts in, they are still having trouble coming up to ensuring that the EELs transfer into the system properly.

And so, we continue to work those. I know that getting over 90 percent by the end of this quarter, the end of this fiscal quarter, which would be the end of April—I am sorry, May—is what my team tells me they are about to do. But as we sign that contract with an objective at 99 percent, that should help to drive additional attention on Lockheed's part into ensuring that we get the fixes made not just to ALIS but also to the underlying data systems with which ALIS interacts.

Ms. SPEIER. Thank you. Just one last question, Mr. Chairman.

Ms. Maurer, I would like your comments on what General Fick just said, as to, are we really fixing the system or just changing the rules so that the numbers look better.

Ms. MAURER. I think we have definitely seen some progress and efforts to change the system. So that is encouraging.

The capability needs statement, in particular, we think was a very important step. Among other things, that document contains some performance measures for ODIN which did not exist for ALIS and still do not exist for ALIS, so we think that is a step in the right direction.

We still have questions about the overall end state for what ODIN is designed to be. There are still a lot of unanswered questions about some of the fundamental issues that we raised in our work on ALIS about cloud usage and software development model and ensuring user feedback and some other things.

So, we are going to continue to watch this, but we are cautiously optimistic, but we will stay studiously skeptical.

Ms. SPEIER. Okay. Thank you. I yield back.

General FICK. And, ma'am, if I could——

Ms. SPEIER. Yes.

General FICK. Ma'am, if I could, the reason I answered my question relative to simply taking the old ALIS code was exactly to your point. Our intent with ODIN is not to just rebrand ALIS. ODIN is all about a new hardware baseline, a new integrated data environment, and new applications and user interfaces that make it a better system from the ground up that we own in its entirety and will then execute.

So, while we are continuing to evolve ALIS and we will transition into ODIN, ODIN will be different. It won't just be a rehashed ALIS.

Ms. SPEIER. All right. Thank you.

I yield back, Mr. Chairman. Thank you.

Mr. NORCROSS. Thank you.

Let me follow up on what Jackie brought up. You just discussed the fact that you are negotiating a sustainment maintenance contract with Lockheed Martin. Most of this hearing has been focused on that affordability gap and the sustainment issues. Built into that will be the answer for the cost savings, if we have any chance of doing that.

Can you share with us those goals?

General FICK. So, I can't disclose the actual negotiating positions right now. But what I can tell you is what our philosophy is as we move forward, from a sustainment perspective and a sustainment affordability perspective.

We look at this in a number of different phases. You will recall that, back in the fall of 2019, Lockheed Martin dropped a white paper on Ms. Lord's desk that defined a tip-to-tail performance-based logistics [PBL] contract approach that they wanted to employ beginning in 2021. There was broad pushback within the Department but a mandate to go study that proposal and to assess what a solution might be that would be acceptable to the services, acceptable to Lockheed Martin, and deliver us improved performance at the same cost or the same performance at decreased cost. So,

looking at, how can we rescope this PBL idea into something that is a win-win for the community.

What we didn't want to do is, we didn't want to get trapped into a mandate to sign a PBL contract that is a bad deal before we were ready to. So, we simultaneously started to negotiate what we are calling the 2021 to 2023—so fiscal years 2021, 2022, and 2023—annual sustainment contract. So, they are effectively three contracts, a contract and options. That will serve as a backstop to us as we begin to pull together the tenets of a supply-support and demand-reduction performance-based logistics contract, which is the piece that we decided was actually probably a good idea from a driving-down-parts-cost perspective.

So, we are currently negotiating that 2021 to 2023 contract. And our entry point for the release of the request for proposal for the PBL contract is the handshake on that 2021 to 2023 contract.

Now, the cost targets that my team has put into place on that 2021 to 2023 contract are intended to drive us towards the $25,000 by fiscal year 2025 target that the program has set for ourselves. Will it get us there by itself? No. But the cost targets that we have established from a cost-per-flight-hour perspective on that 2021 to 2023 contract move us down that path.

At the same time, we are executing the business case assessment [BCA] that is going to help the services to determine what our long-term sustainment strategy needs to be for the enterprise. Is it more PBLs? Is it more organic? Is it what we are doing today, or is it something different? That business case analysis will be released this summer, and we will use that to inform how we move forward.

The third entry criteria, really, into the PBL would be that, as we did that BCA and we figured out what the long-term sustainment strategy needs to be for the Department, that we figure out the data that we need, and then those data become another entry point—that the delivery of that data on the PBL RFP [request for proposals] becomes an entry point for those negotiations.

So we are using the carrot, if you will, of the PBL to make sure that we get a reasonable proposal to secure the tech data that the Department needs to execute its intended strategy at the conclusion of that PBL and moving forward.

That was a little bit complicated, and I apologize, but——

Mr. NORCROSS. No. It goes——

General FICK [continuing]. That was our overarching philosophy.

Mr. NORCROSS [continuing]. Exactly to the point, and we appreciate it.

But the 2021 to 2023 literally bakes in whatever cost savings are going to go for that period of time. So, squeezing additional would come out of flight hours, buying less planes. It is good that there are savings there, but we have now shut off that, realistically, for any additional savings in that first category, as brought up.

And, quite frankly, that gives us a much better focus on what decision we have to make. It makes the numbers very real, or hopefully it will. So, I appreciate the explanation.

I just want to shift a little bit, before I turn it over to Mr. Garamendi, on the plus-ups over the course of the last 7 years. You know, in 2015 there were 4; 11; 11; 20.

Ms. Maurer, as we look at this, what is the impact on the program when we start looking at the additional costs that come with buying more planes than requested? You know, that means the sustainment costs are moved forward, military construction has to be ready for these. Parts, you know, we are fighting over parts each year. When I say "fighting," is it going to sustainment? Is it going to the line? And all this is going on before we even reach full-rate production.

What is the impact that we are looking at when we picked up 97 additional tails over the course of those 7 years?

Ms. MAURER. Sure. Well, first off, obviously, those are political decisions——

Mr. NORCROSS. We understand.

Ms. MAURER [continuing]. So, GAO is not going to say——

Mr. NORCROSS. I am asking for the impact on the program.

Ms. MAURER. But the impact on the program, I think it certainly exacerbates the sustainment challenges that the program has faced over the last several years and, certainly, that the program has come late to the game in taking a strategic approach at addressing sustainment challenges.

Over the last couple of years, we have seen a lot of progress there, but by having additional systems above and beyond the request, it complicates General Fick's ability, and his predecessors', their ability to effectively manage the program.

It also exacerbates the problems with the high concurrency with this program, which you alluded to. We are not technically at full-rate production, but, really, we kind of already are, in terms of the production levels. This program has been highly concurrent from day one.

Mr. NORCROSS. Uh-huh.

Ms. MAURER. In fact, I found a testimony from one of my predecessors from 2000 where GAO's recommendation at that time was to try to avoid high levels of concurrency. That did not happen. That led to all kinds of problems with cost and schedule and contributed to problems with sustainment.

So, the bottom line is, adding planes above and beyond the Department's request complicates efforts to address sustainment. Now, there are bigger-picture considerations, of course—national security considerations, first and foremost. So, I don't want to second-guess those. But it does make things more difficult to manage sustainment costs.

Mr. NORCROSS. But when planes that have been throughout our country and around the world are sitting, waiting for parts——

Ms. MAURER. Right.

Mr. NORCROSS [continuing]. That we are building new ones for, it just seems like a self-inflicted wound that we could avoid. Maybe that is harsh, but from everything that we have heard from you today, it appears that way.

So, General Fick, would you concur with that? Or can you add to it?

General FICK. Well, certainly, sir, I think we could figure out what the cost associated—you know, it would be relatively easy, right? A hundred extra aircraft, 250 hours per year per aircraft—you know, 25,000 extra hours associated with those times, the cost

per flight hour. I mean, that is added, you know, sustainment cost that is being borne by the services that they wouldn't have to otherwise bear, to include the demand on parts associated with those jets. So, I understand your point exactly.

To Ms. Maurer's point, we are effectively at full rate today. As we recover from COVID and we look out into the future, we are, at some level, kind of cresting a long, tall climb that has actually hurt us a little bit from a supply perspective. Because, as Greg Ulmer discussed earlier this morning, we had previously pushed out the stand-up of all of our organic depots to the 2030 kind of timeframe. Right? In the meantime, we are climbing this huge ramp, and now we are relying upon those OEMs [original equipment manufacturers] that are producing the parts to not only produce the parts for the production line, which increased by about 40 percent a year for 3 or 4 years in a row, right, but we are asking them now to also consume the parts that come back and get returned. Right?

So, we have pushed out our organic depots, we are climbing a huge ramp, and we are relying upon those same vendors to do that work. So, I think that is kind of at the heart of why we had a supply problem. Now, we also had a couple of years where we didn't buy spares, and that hurts us too.

So, now, as we crest that wave, right, and we are not going up anymore, but we are kind of leveling out, we have proven we can make that rate. We just need to—in my mind, we just need to settle out at that rate, allow the system to recover and deliver the parts that we need, follow through with our commitment to standing up both the organic depots inside the U.S. and also the OCONUS [outside contiguous United States] depots that will help us from a global capacity perspective to fill out the solution around the world.

There is a lot of catching up, sir, frankly, that we have to do as a program. And that is what me and my team are doing every single day.

Mr. NORCROSS. And that is the point we are trying to get at, exactly. I want to buy a shiny, new one. I love them coming off the line, lower than $80 million. But the cost is—my good friend, sustainment, over here to my right, is, when we can't get those parts, you will have a shiny new one, while others are sitting there. And that is a tradeoff.

You know, as I said, we are all in this together, but we are trying to be efficient and be ready. It just seems we can do it better.

With that, I will defer to the chairman of Readiness, Mr. Garamendi.

Mr. GARAMENDI. Thank you very much.

The discussion on ALIS and ODIN is very, very important. It seems to be a key part of the operation of the aircraft as well as the sustainment. And so, you are moving forward on it. You are getting a quarterly update. We really need a quarterly update too.

And we need to know how we can assist the Joint Program Office in its negotiations, which were discussed. I don't want to go back through it, but I want to add to that discussion that they are going to need some leverage here in order to successfully deal with the PBL on the ALIS, ODIN, and all of the elements to it.

A couple of other things.

You know, clearly, there has been a disconnect. First of all, the sustainment and maintenance was not at the outset of this program, and it didn't come along until very late in the program. And, to this day, the sustainment piece of it is not yet in place, to catch up with the base number of planes.

And then the problem was made worse by the additional 97 planes that we are responsible, together with Lockheed and other contractors that wanted to have the extra number of planes, the extra work, the extra profit, and the like. So, we share that problem.

And I can assure you that, this year, if anybody suggests a plus-up, there will be one hell of a fight, and I don't propose to lose it. And I think I have some allies on that.

Nevertheless, that doesn't solve the problem, because we still have that backlog, caused in major part by the plus-up and, equally, by no prior planning and preparation for the ongoing sustainment and maintenance.

There has been an ongoing effort, I recall from earlier hearings, that the Air Force and the Navy are in a discussion about simply taking over the totality of their operations from the joint planning office.

Where is that, General Fick? Is there really a desire on the part of the Air Force and the Navy to simply say, "We are going to do this ourselves, we don't need to go through the JPO"? Where are we? What is happening there?

General FICK. So, sir, I can't speak to what the Navy and the Air Force are thinking about doing on things that I don't know about, but I am not aware of any plans in place right now to break apart the Joint Program Office into any service-specific program office.

I will tell you, if you don't mind going on a little journey with me, when I got to the program office 4 years ago and I was a new—not a new, but I was a one-star and I was talking to a Navy captain in the hallway, I looked at him and I said, "Hey, Captain. It is good to see how the Navy runs programs, because, boy, this isn't the way the Air Force runs programs." And he looked at me with terror in his eyes and said, "Oh, my gosh, sir. I thought this was the way the Air Force ran programs."

So, at that point, it dawned on me that we were very unusual. Right? And so we started to look at ways that we make this program look and feel much more like a normal program for the people who are in the program office so that they don't have to spend so much time trying to figure out how do things work around here.

So, in the spring of 2020, so just over a year ago, we actually pivoted the organizational construct within the program office. So, now, instead of a global director of development, production, and sustainment, I have a program management office director who is responsible for the cradle-to-grave development, production, and sustainment of the air vehicle; I have another one that is responsible for the engine; I have another one that is responsible for the maintenance data systems, to include ALIS and ODIN; I have one that is responsible for training systems; and one that is responsible for combat data systems, which is my office that generates—that

works closely with the wing down at Eglin to produce our mission data files.

Giving that cradle-to-grave responsibility to a senior materiel leader-type person in a very, very similar way to the way we run program offices in both the Air Force and Department of the Navy is helping to add discipline and visibility in places where we didn't have discipline and visibility before.

We are starting to see, in my mind at least, very positive outcomes associated with that attention. As a matter of fact, a lot of the progress that we have seen on the propulsion side relative to the stand-up—accelerating the stand-up of the F135 facilities at Tinker is a direct result of the Navy captain that is running that shop now and just doing a great job.

So we have found that, internal to the program office, we were a little bit odd, we were a little bit unusual, and it was taking a long time for people to learn how to do the things that they need to do and then to just go ahead and do them. And so, by making this restructure, it has allowed us to empower our leaders within the program office with a greater sense of ownership to really get after our customers' biggest needs.

So, I think we are making steps in the right direction. And we deliberately, Ms. Skeen and myself and Admiral Chebi, my deputy PEO, took this opportunity to divide the organization in this way because that makes sense and preserves the synergy of the program office across all of the variants, across all of the partners, and across all of the services, while still allowing a feel that looks and feels a lot more like what people are used to.

Mr. GARAMENDI. I appreciate your attempt to reorganize. We would hope that it would be a successful reorganization.

So, I will cross off of my "let's watch it" list the dismantlement of the Joint Program Office by either the Air Force—by the Air Force or the Navy that actually started this discussion in January of 2019. So, we will find out if somebody is behind your back doing something.

I want to focus on the depots. Earlier, there was a discussion by Lockheed of 64 depots. I assume those are depots around the world in various countries and the like. I am going to let Israel worry about its depots, but I shall worry about American depots.

So, this is a question to General Abba: How is it going? How are your depots coming along?

General ABBA. Well, sir, the 68 depots that will eventually be stood up, as General Fick mentioned earlier, 32 of those are stood up now. Of the 62 depots, ultimately, 38 of those will be Air Force depots. The other 30 will be divided amongst the other services to provide those.

Clearly, the one that has gotten the most attention right now, as we have discussed, is the F135 depot out at Tinker, the heavy maintenance center there. And as we heard this morning in the first panel, there has been significant improvement in increasing the work in progress, as well as they are initiating significant efforts to bring down the turnaround time to fix the engines.

We have a production target this year of 40 power modules to be produced at the heavy maintenance center, with that looking to in-

crease to 60 the next year and then follow-on expansions in partnership with the Joint Program Office other than that.

So that is really the extent of what I can explain from an Air Force perspective because we participate as part of the broader partnership in working with our JPO teammates as well as the OEMs to execute those repairs.

Mr. GARAMENDI. In the future, do you foresee the continuation of the contractors basically operating the heavy maintenance and the lighter maintenance at the various depots, or is that going to become—bring it in house, organic? How do you perceive the future here?

General ABBA. Sir, I would say, as part of a player within the broader architecture, I would have to defer to the PEO on the architecture for the follow-on sustainment strategy.

Mr. GARAMENDI. Well, then, that must be General Fick.

General FICK. Yes, sir. So those 68 depots—those 68 workloads are distributed across the depots, as General Abba mentioned. They are vital, right, to us getting after the 7,300-item stack of repairables that we have to consume and get back into a place where we can install them into aircraft.

As each of those stand up—and we are expecting to do 11 this year to get us to 43 by the end of the year; that is our target—we see challenges for 3 of those. So somewhere between 40 and 43 is where we will end up. But we are still targeting, as Greg Ulmer mentioned previously, having all 68 of them stood up by the end of 2024.

Each one of them will likely come with a slightly different business arrangement between the depot and the OEM that currently does the repair work. And I am not familiar with all of the different methods, but public-private partnership is certainly one of them. But the degree to which they continue to rely on the OEMs I think will vary, depot by depot.

What we will, though, continue to need to do is, we will over time need to continue to rely on the OEMs to conduct some of that repair work, as well as relying upon the OCONUS depots, as you mentioned, to do some fraction of the work as well.

What I can tell you is that, for the workloads that have been activated to date, my data suggests that 67 percent of the work for those parts and components is currently flowing through those depots, with the remainder going back to the OEMs.

So, once we have stood them up, we are using them, some of them at 100 percent, some of them at less. But, in aggregate, about two-thirds of the work that is currently being done for those parts that have been activated is being done by the organic depots.

Mr. GARAMENDI. Of the total cost of the maintenance, how much of that is OEM, how much of that is organic? Or do you have that information at all? In other words, where can you reduce the costs on the maintenance side?

General FICK. Yeah. So, my options and opportunities to reduce cost on the maintenance side really come in four buckets.

The first of those is that sustaining support that we talked about. It is the field support engineers and field support representatives on the flight line, and it is ALIS administrators. So, as we work the transition from ALIS to ODIN and we end up with an

ODIN that is much more user-friendly than ALIS is, we will start to see the number of ALIS administrators come down and, I like to say, dollars walk on two feet. And then those ALIS administrators walk off the flight line, and we end up just using our organic folks to do that work. So that is one big opportunity.

The second opportunity, as I mentioned before—sorry, sir, you weren't in the room. The second opportunity is really U.S. military maintenance manpower. Right? An aircraft, by its nature, requires a number of skill sets to be utilized—launching aircraft, recovering aircraft, performing maintenance on those aircraft. And, by the aircraft's design, to Ms. Maurer's point, some of those things are fixed, at this point, you know, 20 years down the road——

Mr. GARAMENDI. Excuse me.

General FICK [continuing]. But—sir.

Mr. GARAMENDI. You are very rapidly going past time allotted. Our chairman is getting anxious——

General FICK. Sorry.

Mr. GARAMENDI [continuing]. And I am having trouble following you. But you said there are four pieces.

General FICK. Right. The third piece is air vehicle parts, and the fourth piece is propulsion system parts. And——

Mr. GARAMENDI. I would appreciate a memo from you on those four which you have identified as the four keys to reduce the cost of maintaining these aircraft.

General FICK. Yes, sir.

[The information referred to can be found in the Appendix on page 193.]

Mr. GARAMENDI. And it doesn't have to be a great deal of detail, but I would like to put into my little watch-it list the four key items that you have identified to reduce the cost. Okay?

General FICK. Absolutely.

Mr. GARAMENDI. And secondly, we already know from Ms. Maurer that you have been asked by Ms. Speier, if there are 19 remaining, how is that going. Okay?

I yield back.

Mr. NORCROSS. Mr. Garamendi, we will come around again.

I saw we were joined by our colleague, Mark Veasey. And, as I looked at his district, he has a lot of great things down there, including the Lockheed Martin facility, which is a well-oiled machine, with the IAM [International Association of Machinists and Aerospace Workers] representing them. But he also has the Dallas Cowboys, so he is in mixed company there.

Mr. VEASEY. Mr. Chairman——

Mr. NORCROSS. So, I will defer the rest of my comments, but please.

Mr. VEASEY. Mr. Chairman, thank you very much. And very appropriate for you to mention the Dallas Cowboys in a HASC [House Armed Services Committee] hearing, as they are America's team. So, we appreciate that.

Lieutenant General Fick, the mission capable and fully mission capable rate are often used as measures of readiness for the F–35. Can you talk about the difference between the two and why FMC is regularly lower than MC?

General FICK. Yes, sir.

The mission capable rate is—both of them use as their base the number of aircraft that are on the flight line of the unit being considered. And, really, this is a unit-by-unit measure, but it is the number of tails that they actually have on the flight line.

The mission capable rate takes the number of aircraft that are capable of performing one of the missions, at least one of the missions, in the unit's document, divided by that total number.

And so that is typically a higher fraction or a higher percentage than a fully mission capable aircraft, because the fully mission capable aircraft requires that all of the missions that the unit must execute must be executable by that aircraft for it to be declared fully mission capable.

Mr. VEASEY. Okay.

General FICK. Does that make sense?

Mr. VEASEY. Yeah, that does. Yeah, that does make sense.

General FICK. Okay.

Mr. VEASEY. So, are you seeing improvements in the readiness of the F–35 fleet? And can you share some news with the committee about the mission capable rates that you are seeing, particularly in the operational units? Because I have heard they have been trending as high as 90 percent for deployed units.

General FICK. Absolutely, sir.

So, we have been seeing increases, both MC and FMC increases, between 2019 and 2020, and they are not insignificant. Across the fleet, we saw the average in 2019 go from 63.2 percent, from an MC perspective, to 68.5 percent. From an FMC, or fully mission capable, perspective, we saw that go from 33½ percent to just shy of 37 percent.

So that number, to me, is still unsatisfying, but it is moving in the right direction.

Mr. VEASEY. Right.

General FICK. If you look down at the service specifics, at the variant specifics, you see a little bit of a different story. Because what you see from a U.S. Air Force F–35A perspective is that the MC rate is above 73 percent. You see the FMC rate is above 54 percent. And both of those are 10 percent jumps over last year. But if at the fleet level we are only up by 5 percent, that means that somebody else isn't quite doing so well.

And those are, right now, the Marine Corps and the Navy, with their Bravos and Charlies, are moving very, very small, if at all. As a matter of fact, I think we stepped backwards just a little bit with the Navy this past year, from just over 59 to just under 59 percent, from an MC perspective.

So, it is a sensitive metric. It goes base by base and unit by unit, and it varies across the enterprise.

Mr. VEASEY. Okay. Okay.

General FICK. And General Abba may be able to amplify a little bit.

Mr. VEASEY. Yeah, please, General Abba.

General ABBA. Thank you, Congressman.

As General Fick alluded to, aggregation of data versus looking at unit-level specifics tells very, very different stories over time.

For over the 18 months that our Hill Air Force Base airmen were deployed, flying combat sorties, 4,000 combat sorties, 20,000 com-

bat hours, those 3 units collectively averaged just shy of 75 percent fully mission capable while they were deployed.

But, even within these data sets, there are lots of various trails we could go down, because even the Air Force fleet is divided between our combat-coded units, the ones that have forward-deployed combat responsibilities, and our testing and training fleet. And our testing and training fleet doesn't tend to be as healthy as our combat-coded fleets are.

There are many reasons for that, not the least of which is, as we accept new airplanes into our fleet, we push them forward into the combat units. And as the weapons systems matured, the newer jets have learned a lot of lessons from their predecessors, if you will, in production. So, the airplanes become, you know, much more reliable.

You know, on this airplane, the newer-lot airplanes that we are receiving actually have the best break rate in the United States Air Force, down below 4 percent. So, when the airplanes get airborne, they are landing what we call Code 1; they are coming back very healthy.

So how we dissect this problem to examine the readiness elements of that is really key, and each of the users has their own unique experience. I will tell you that, dating back at least to January of 2020, the Air Force combat-coded fully mission capable average has never been below 60 percent.

Mr. VEASEY. Yeah.

Well, thank you very much, Mr. Chairman. I yield back. Thank you.

Mr. NORCROSS. John.

Mr. GARAMENDI. General Abba, you are into an issue that has been on my mind for some time. Not all of these aircraft are the same. And I would appreciate from the joint office, as well as from the Air Force and the Navy and the Marine Corps, a differentiation of the various blocks through time.

And if your analysis of the operations in the Middle East indicate that the newer planes were performing at a higher function and the older planes are not going to be used for that purpose but rather for training, we need to understand this. And it may lead to a better feeling, or not. But if you can differentiate on the block by block.

General FLICK. Sir, absolutely, we can do that. We actually have—we have data that shows lot by lot——

Mr. GARAMENDI. I am sorry. I have been listening too long. My hearing was never good at the outset. But I am going to want to listen to what you say, so if you could articulate a little better or a little louder, it would be helpful.

General FICK. So, sir, we have data that will show lot by lot and base by base or installation by installation what the MC and FMC rates are. We track that very, very closely. And we can provide those data to you and your staffs directly so that can you see that. Because it is, as General Abba mentioned—you see the older tails not performing as well as the newer tails.

That was actually one of the things that we looked at very, very closely when we decided to accelerate that transition of our early TR1 [Tech Refresh 1] jets into a TR2 [Tech Refresh 2] configura-

tion. So we actually accelerated that process by about 13 or 14 months. And so now we are talking about TR3, right, but we still had TR1 jets in the fleet until the September timeframe. And that was when we inducted the last TR1 tail into a modification to turn it into a TR2.

Why did we do that? Because the TR2 jets are able to use the newest software, the newest prognostic self-management maint—P–H–M—prognostic self-management algorithms, and electronic warfare systems. So that allowed us to take those systems that historically did not perform very well, get them off the tail, put the new hardware in, and move forward.

So, we are doing things like that to actively manage the fleet to try to ensure that we are up to date and getting the most reliable jets out that we can.

Mr. GARAMENDI. So, the granularity of the analysis would be helpful to us.

The other—you said—and I hadn't considered this—you are talking place by place. Are you referring to the Army, Navy, Marine Corps, or, within the Air Force, various sectors that are better than others? And if so, why is it?

General FICK. Yes, sir. We track the sustainment metrics across the fleet. Literally, we have the data tail by tail, but we typically aggregate it at the squadron level so that you can see by location, by country, by squadron even, what their performance actually is.

Mr. GARAMENDI. Thank you very much.

I yield.

Mr. NORCROSS. Mark, anything else? You good?

We just want to thank all of the men and women who have been working so hard to make this a successful program, literally service men and women from around the world, in a pandemic. It is not short on us how special that is, and for your service, much appreciated.

I think this was very helpful. We have identified some issues, but, also, there are some very good things going on with this aircraft. It is certainly the most capable in the world. We just need to make it a little bit more capable, as we say.

So, Ms. Maurer, thank you, from GAO; from Lockheed Martin, Mr. Ulmer; Mr. Bromberg from Pratt & Whitney.

And the last thing that I will say is, we are all in this together. We need to make this work, and together we will.

With that, we are adjourned.

[Whereupon, at 1:37 p.m., the subcommittees were adjourned.]

A P P E N D I X

APRIL 22, 2021

PREPARED STATEMENTS SUBMITTED FOR THE RECORD

APRIL 22, 2021

Statement of the Honorable Donald Norcross
Chairman, Subcommittee on Tactical Air and Land Forces
(Joint Hearing with Readiness)
"Update on F-35 Program Accomplishments, Issues, and Risks"
April 22, 2021

The hearing will come to order.

I want to welcome everyone to our first Joint, hybrid hearing of the 117th Congress between the Readiness and Tactical Air and Land Forces subcommittees, and I thank my good friends from California, Colorado, and Missouri for agreeing to this most important hearing on the Department's most expensive and complex program in history, the F-35 Joint Strike Fighter.

I would like to welcome the members who are joining today's joint hearing remotely. Members who are participating remotely must be visible on-screen for the purposes of identity verification, establishing and maintaining a quorum, participating in the proceeding, and voting. Remote attending Members must continue to use the software platform's video function the entire time while in attendance, unless they experience connectivity issues or other technical problems that render them unable to participate on camera. If a Member experiences technical difficulties they should contact the committee's staff for assistance.

Video of Members' participation will be broadcast in the room and via the television and internet feeds. Members participating remotely must seek recognition verbally, and they are asked to mute their microphones when they are not speaking.

Remote Members may leave and rejoin the proceeding. However, if remote Members depart our hearing for a short while, for reasons other than joining a different proceeding, they should leave the video function on. If Members will be absent for a significant period, or depart to join a different proceeding, they should exit the software platform entirely and then re-join it when they return. Members may use the software platform's chat feature to communicate with staff regarding only technical or logistical support issues.

I have designated a committee staff member to, if necessary, mute unrecognized Members' microphones to cancel any inadvertent background noise that may disrupt the proceeding.

Finally, for all Members, staff and attendees in the hearing room…the Chair reminds everyone that they are required to observe standards of courtesy and decorum during committee proceedings. This requirement includes the responsibility to protect public safety and health, particularly during a pandemic. Members, staff, and attendees are required to wear masks at all times in the hearing room without exception. Members who are attending this proceeding in person will not be recognized unless they are wearing a mask, and recognition will be withdrawn if a Member removes his or her mask while speaking. The Chair expects all Members, staff, and attendees to adhere to this requirement as a sign of

respect for the health, safety, and well-being of others. The Chair views the failure to wear a mask as a serious breach of decorum.

With that, I will now give my opening statement.

We have two panels of witnesses testifying and I welcome and thank both our distinguished panels of witnesses for taking the time to come before us to discuss the accomplishments, issues and risks of this program.

We are going to hear from program leaders of the Department of Defense and the two industry prime contractors, as well as, the Government Accountability Office serving as our independent agency helping us evaluate production and sustainment of this challenging program. Please note that our GAO witness will participate on both panels today.

This upcoming October will mark the 20-year anniversary since the start of F-35 development and we still find the program struggling with the risky, highly concurrent acquisition decisions made by past program leaders. The F-35 has been plagued throughout with unforeseen funding increases for development, production, and now in its maintenance and sustainment activities.

While recently accomplishing the achievement of an aircraft recurring flyaway cost below $80 million dollars for the Air Force's F-35A aircraft, the program has failed to achieve full rate production as planned, still finds itself in low-rate production, and delivering less than the warfighter required Technical Refresh three (3) and Block four (4) combat capability. F-35 is still at least five years away from declaring full operational capability, assuming everything goes according to the current plan. Which I find highly doubtful after this program's lackluster track record for achieving that which has been planned over the past 20 years.

My current skepticism is driven by recent media reporting that completion of the Joint Simulation Environment testing supporting initial test and evaluation activities may not complete until the end of 2022, which is a delay of more than three years beyond the plan.

Also, after only a little more than two years into development, I understand that Technical Refresh 3 hardware supporting Block 4 capability is approximately 5 months behind schedule and will likely be nearly $450 million over its planned budget.

Additionally, Block 4 software development is on shaky ground because the current Block "3 F" software, which is the foundation for Block 4, is a multi-year patchwork of inefficient and poorly designed software code that has been rushed to preserve program schedule without undergoing the rigorous and full testing to find and properly fix deficiencies prior to fielding, resulting in significant software issues at times being discovered in the field.

Knowing that Block 4 capability is a significant leap in combat capability and mission systems integration complexity, I'm very concerned the program will be unable to maintain its projected pace of Block 4 development and fielding without encountering significant software issues resulting in further delay.

And finally, I'm very concerned about the actual and projected sustainment costs that have been deemed unaffordable recently by senior Air Force leaders. This question of estimated cost and affordability could result in a 47 percent reduction to the Air Force's planned inventory goal of 1,763 aircraft just to remain within their future allocated budget.

I know my Readiness colleagues will address the program's specific sustainment concerns, but if the program fails to significantly control and reduce actual and projected sustainment costs, we may need to invest in other more affordable platforms to backfill an operational shortfall of potentially over 800 tactical fighter aircraft.

The Tactical Air and Land Forces subcommittee has been supportive of this program in the past, but as I have stated many times, we don't have unlimited resources which seem needed continuously as we chase the elusive "affordability" of this program.

And given the overall affordability concerns that exist within the program, I would not support any requests for additional aircraft beyond what may be contained in this year's President's budget request.

With that, I now recognize our Ranking Member of Tactical Air and Land Forces, Mrs. Hartzler.

Statement of John Garamendi
Chairman, Readiness Subcommittee of the
House Armed Services Committee
Update on F-35 Program Accomplishments, Issues, and Risks
April 22, 2021

I thank the witnesses for attending today. The F-35 is the most expensive program in the history of the Department of Defense, and sustainment costs alone are estimated to exceed $1.2 trillion over the life of the program. The program is over budget, routinely delivers promised capabilities late, and Mission Capability rates do not meet service thresholds. And it seems to be the case that industry's solution to many of these problems is to ask the taxpayer to throw more money at the problem. Well, we've tried that, and it hasn't worked. So I want to talk today about what YOU are doing to drive cost out of this program, to expedite delivery of promised capabilities, and to increase the Full Mission Capability rate of this aircraft. The F-35 is designed to generate high sortie rates of Fully Mission Capable aircraft that can operate and persist inside the threat envelope of our near-peer adversaries. Ladies and gentlemen, we are 20-years into this program, and we have not yet achieved this goal.

The propulsion sustainment system for this aircraft is not meeting requirements. On the good news side of the ledger, the engine's Mission Capable rate is higher than the 94% requirement, and the engine's "time-on-wing" rate also exceeds requirements. So I then have a hard time understanding why the Joint Program Office forecasts that greater than one-third of the F-35 fleet will not have a serviceable engine by 2030; that our engine repair system is not meeting capacity goals; and that recent engine power module issues resulted in 9 unscheduled engine changes during a 2020 Air Force deployment. Is this a function of not having the required repair capability and capacity at our organic repair facilities? Are we missing the right tooling and Ground Support Equipment? Do we need better access to technical data? Please address these questions and help us understand how we can increase capacity, drive down demand, and eliminate the engine repair backlog. Because I can tell you that status quo is unaffordable and unacceptable.

Turning to aircraft availability: the Mission Capable rate objectives are 90% for the Air Force, 85% for the Navy, and 85% for the Marine Corps. Yet we have seen a stable Non-mission Capable for Supply rate in the high teens. This NMC-S rate alone makes it impossible for the Services to achieve their readiness objectives. What are we doing to address this? I look forward to hearing from our GAO witness today—Ms. Diana Maurer—on the health of the supply chain and parts system. Are our problems a function of not spending enough money on spare parts and repair capability? Do we need to rebalance resources away from aircraft procurement, and into the sustainment system? The Joint Program Office briefed me on the high readiness rates of recent Air Force F-35 combat deployments.

While this is commendable, I question whether achieving high readiness in one location creates a lack of readiness somewhere else, and whether the supply system could meet demand signals during large scale combat operations. Moreover, the 2020 Full Mission Capable rates for the F-35A, F-35B, and F-35C were 54%, 15%, and 7%, respectively. Ladies and gentlemen, these numbers are not close to requirements.

Lastly, I'd like to address affordability. In 2019 GAO reported that steady-state projected costs of the aircraft would exceed affordability constraints for each of the Services. In fact, GAO reported that the Air Force would have to reduce sustainment costs by 43%; the Marine Corps would have to reduce sustainment costs by 24%; the Navy would have to reduce sustainment costs by 5%, in order to afford their end-state production goals. I understand that GAO revisited these numbers in their most recent F-35 sustainment report which is due to be released within the next few weeks. I'd ask Ms. Maurer from GAO to address her preliminary findings on affordability, and whether the numbers are moving in the right direction. And I'd then ask each of our witnesses today to address what actions they are taking to drive down sustainment costs to reach Service-specific affordability constraints.

In closing, we need to make some hard decisions on this program. I demand that industry pulls every level at their disposal to drive down cost. I promise you that the solution to this problem is NOT to accelerate aircraft procurement, or to procure in excess of the President's Budget request. In fact, we may need to look at shifting resources away from procurement and into sustainment of the aircraft that we already own and operate. And perhaps we need to explore competition in the sustainment world as a means of driving down cost. What I can tell you today is the taxpayers are not getting what they paid for, and the warfighters are not getting what they were promised. Things need to change—rapidly. I yield back.

United States Government Accountability Office

Testimony

Before the Subcommittees on Readiness and Tactical Air and Land Forces, Committee on Armed Services, House of Representatives

For Release on Delivery
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F-35 SUSTAINMENT

Enhanced Attention to and Oversight of F-35 Affordability Are Needed

Statement of Diana Maurer, Director,
Defense Capabilities and Management

GAO-21-505T

GAO@100 Highlights

Highlights of GAO-21-505T, a testimony before the Subcommittees on Readiness and Tactical Air and Land Forces, Committee on Armed Services, House of Representatives

April 22, 2021

F-35 SUSTAINMENT

Enhanced Attention to and Oversight of F-35 Affordability Are Needed

Why GAO Did This Study

The F-35 aircraft with its advanced capabilities represents a growing portion of DOD's tactical aviation fleet—with the Air Force, Marine Corps, and Navy currently flying about 400 of the aircraft. It is also DOD's most ambitious and costly weapon system in history, with estimated life-of-program costs exceeding $1.7 trillion. DOD plans to procure nearly 2,500 F-35s at an estimated total acquisition cost of just under $400 billion. The remaining $1.3 trillion in life cycle costs is associated with operating and sustaining the aircraft.

This statement, among other things, assesses the extent to which (1) the F-35 has met warfighter-required mission capable rates, and (2) DOD has reduced the F-35's estimated life cycle sustainment costs and made progress in meeting its affordability constraints. This statement is largely based on GAO's draft report, which was provided to DOD in March for review and comment. For that report and this statement, GAO reviewed program documentation, analyzed performance and cost data, collected data from F-35 locations, and interviewed officials.

What GAO Recommends

GAO's draft report suggested that Congress should consider (1) requiring DOD to report annually on progress in achieving the affordability constraints, and (2) making F-35 aircraft procurement decisions contingent on DOD's progress in achieving these constraints. GAO also made four recommendations to DOD, including that it assess its cost reduction efforts and F-35 program requirements, and develop a plan to ensure it can afford to sustain the future F-35 fleet.

View GAO-21-505T. For more information, contact Diana Maurer at (202) 512-9627 or maurerd@gao.gov.

What GAO Found

F-35 mission capable rates—a measure of the readiness of an aircraft fleet—have recently improved, but still fall short of warfighter requirements, as discussed in our draft report. Specifically, from fiscal year 2019 to fiscal year 2020, the U.S. F-35 fleet's average annual (1) mission capable rate—the percentage of time during which the aircraft can fly and perform one of its tasked missions—improved from 59 to 69 percent; and (2) full mission capable rate—the percentage of time during which the aircraft can perform all of its tasked missions—improved from 32 to 39 percent. Both metrics fall below the services' objectives. For example, in fiscal year 2020 the Air Force F-35A full mission capable rate was 54 percent, versus a 72 percent objective.

Since 2012, F-35 estimated sustainment costs over its 66-year life cycle have increased steadily, from $1.11 trillion to $1.27 trillion, despite efforts to reduce costs. The services face a substantial and growing gap between estimated sustainment costs and affordability constraints—i.e., costs per tail (aircraft) per year that the services project they can afford—totaling about $6 billion in 2036 alone (see fig.). The services will collectively be confronted with tens of billions of dollars in sustainment costs that they project as unaffordable during the program.

Gap between F-35 Affordability Constraints and Estimated Sustainment Costs in 2036

Service and aircraft	2020 JPO CPTPY estimate in steady state[a]		Affordability constraint		Gap between projected cost and affordability constraint		Planned aircraft total in steady state[a] year 2036		Total cost overrun in steady state[a] year 2036
Air Force F-35A	($7.8	-	$4.1)	=	$3.7	x	1,192	=	$4.4 billion
Marine Corps F-35B	($9.1	-	$6.8)	=	$2.3	x	353	=	$812 million
Marine Corps F-35C	($7.9	-	$6.8)	=	$1.1	x	67	=	$74 million
Navy F-35C	($9.9	-	$7.5)	=	$2.4	x	273	=	$655 million
CPTPY cost per tail (aircraft) per year					Costs in millions unless otherwise noted				Almost $6 billion

Source: GAO analysis of Joint Program Office (JPO) data. | GAO-21-505T

Note: Costs are in constant year 2012 dollars as that was the year when the F-35 program was most recently re-baselined.
[a]Steady state years for the F-35 program are defined in each respective service's affordability analysis as: US Air Force/F-35A – 2036-2041; US Marine Corps/F-35B – 2033-2037; US Navy/F-35C – 2036-2043. Steady state refers to the program's peak operating point.

The Air Force needs to reduce estimated costs per tail per year by $3.7 million (or 47 percent) by 2036 or it will incur $4.4 billion in costs beyond what it currently projects it could afford in that year alone. Cost reductions become increasingly difficult as the program grows and matures. However, GAO found there is no agreed upon approach to achieve the constraints. Without an assessment of cost-reduction efforts and program requirements (such as number of planned aircraft), along with a plan, the Department of Defense (DOD) may continue to invest resources in a program it ultimately cannot afford. Congress requiring DOD to report on its progress in achieving affordability constraints and making F-35 procurements contingent on DOD's demonstrated progress would enhance DOD's accountability for taking the necessary and appropriate actions to afford sustaining the F-35 fleet.

Chairmen Garamendi and Norcross, Ranking Members Lamborn and Hartzler, and Members of the Subcommittees:

Thank you for the opportunity to be here today to discuss the Department of Defense's (DOD) sustainment of the F-35 aircraft and its associated costs. As you know, the F-35 Lightning II aircraft and its advanced capabilities represent a growing portion of the tactical aviation fleet for DOD. The F-35 is also DOD's most ambitious and costly weapon system in history, with overall costs for the program estimated by DOD at more than $1.7 trillion over its 66-year life cycle.[1] Current DOD plans call for procuring 2,456 F-35s at an estimated total acquisition cost of just under $400 billion. This leaves the majority of estimated F-35 program costs, approximately $1.3 trillion, associated with the sustainment of the aircraft.[2] For the past decade, DOD has been working to deliver a sustainment strategy that will be both affordable and able to meet the needs of the Air Force, Navy, and Marine Corps (hereinafter referred to as "the services"). This remains an ongoing challenge, as DOD continues to support a rapidly expanding F-35 fleet.

My testimony today is largely based on our draft report, which we provided to DOD last month for review and comment.[3] However, it is also informed by our body of work issued from 2014 through 2020 addressing F-35 sustainment, affordability, the Autonomic Logistics Information System (ALIS), operations, and the global supply chain. This testimony (1) assesses the extent to which the F-35 has met warfighter-required mission capable rates, (2) provides an update on the status of significant sustainment-related challenges facing the F-35 program, and (3) assesses the extent to which DOD has reduced the F-35's estimated life cycle sustainment costs and made progress in meeting its affordability constraints—that is, the amount of financial resources a military service can afford in order to operate and support a system, given future force budgets and portfolio prioritizations.

[1]The $1.7 trillion reflects then-year dollars. Then-year dollars include the effects of inflation or escalation.

[2]Historically, the official sustainment cost estimate for the F-35 program is produced by the Office of the Secretary of Defense Cost Assessment & Program Evaluation (CAPE). This estimate was most recently updated in June 2020.

[3]House Report 116-120, accompanying a proposed bill for the National Defense Authorization Act for Fiscal Year 2020, included a provision for us to review DOD's sustainment efforts related to the F-35.

For our draft report, we collected and analyzed performance metrics, such as mission capable and full mission capable rates, from fiscal years 2015 through 2020 for the U.S. F-35 fleet. We surveyed 12 U.S. F-35 locations to collect sustainment-related inputs, data, and flight-line experiences, receiving responses from 11 of the 12 locations. We collected and reviewed each of DOD's three sustainment cost estimates—the Secretary of Defense Cost Assessment and Program Evaluation's (CAPE) Independent Cost Estimate, the F-35 Joint Program Office's Annual Cost Estimate, and the Joint Service Cost Position—completed in 2020. We reviewed the cost estimates to determine current sustainment-related cost projections, identify deviations from previous cost estimates, and assess any progress made toward achieving the services' affordability constraints.[4] Finally, we conducted interviews with officials from the F-35 Joint Program Office, the services, the Office of the Under Secretary of Defense for Acquisition and Sustainment, CAPE, Lockheed Martin (the prime contractor for the F-35 aircraft system), and Pratt and Whitney (the prime contractor for the F-35 engine) to discuss sustainment-related challenges impacting the fleet as well as current and projected sustainment-related costs for the F-35.

We performed the work on which this statement is based from March 2020 through April 2021 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

Background

The program has developed and is delivering three variants of the F-35 aircraft:

- **F-35A** – A conventional take-off and landing variant that is intended to replace Air Force F-16 fighters and A-10 attack aircraft (and possibly

[4]We did not independently evaluate or assess the cost estimates' reliability.

F-15 fighters).[5] The Air Force plans to procure 1,763 F-35As, making that service the largest customer in the F-35 program.

- **F-35B** – A short take-off and vertical landing variant that is intended to replace Marine Corps AV-8B Harrier vertical/short take-off and landing attack aircraft and Marine Corps F/A-18A/B/C/D strike fighters, which are conventional take-off and landing aircraft. The Marine Corps plans to procure 353 F-35Bs.
- **F-35C** – A carrier-suitable variant that is intended to complement the Navy F/A-18E/F, an aircraft the Navy has been procuring since 1997. The Navy plans to procure 273 F-35Cs. Furthermore, to supplement its own aircraft fleet, the Marine Corps plans to procure 67 F-35Cs.

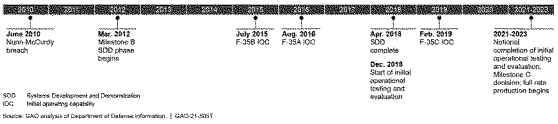
As of November 2020, more than 525 U.S. and international aircraft had been fielded and were operating from various sites worldwide. This represented an increase of more than 270 aircraft relative to August 2017, and 175 more aircraft than were fielded and operating in February 2019. By 2023 the global F-35 fleet is expected to expand, with more than 1,100 aircraft planned across 43 operational sites. In total, the program participants plan to purchase more than 3,300 F-35 aircraft, with the U.S. services planning to purchase nearly 2,500 of those aircraft.

DOD Instruction 5000.85, *Major Capability Acquisition,* states that the purpose of key milestone decisions is to carefully assess a program's readiness to proceed to the next phase of the acquisition process and make a sound investment decision committing the department's financial resources. The next such milestone for the F-35 program is Milestone C, which gives the program the approval to move into full-rate production of the aircraft. Milestone C cannot be declared until DOD has completed several efforts, including Initial Operational Test and Evaluation, which began back in December 2018. According to DOD officials, Initial Operational Test and Evaluation will likely not be completed until sometime in the late 2021-or-2022 time frame. Once all of the requisite factors have been completed and reviewed, the program can declare

[5]For information on the aircraft that the F-35 is replacing, including their ability to meet mission capable rate goals and associated operating and support (O&S) costs, see GAO, *Weapon System Sustainment: Aircraft Mission Capable Rates Generally Did Not Meet Goals and Cost of Sustaining Selected Weapon Systems Varied Widely,* GAO-21-101SP (Washington, D.C.: Nov. 19, 2020). This is a public version of a more detailed August 2020 sensitive report: GAO, *Weapon System Sustainment: Aircraft Mission Capable Rates Generally Did Not Meet Goals and Cost of Sustaining Selected Weapon Systems Varied Widely*, GAO-20-67SPSU (Washington, D.C.: Aug. 27, 2020).

Milestone C and enter into full-rate production. However, as we reported in March 2021, the F-35 program has not identified an official date for a full-rate production decision.[6] According to DOD officials, it could be late 2022 or 2023. See figure 1 for completed and planned milestones for the F-35 program.

Figure 1: F-35 Key Dates and Milestones



Source: GAO analysis of Department of Defense information. | GAO-21-505T

We have published a series of reports examining sustainment of the F-35. In particular, since 2014, we have reported significant challenges DOD faced in sustaining a growing F-35 fleet, such as the availability of spare parts.[7] As a result of those challenges, F-35 performance has not met warfighter-required mission capable rates—that is, the percentage of total time during which the aircraft can fly and perform at least one of its missions.

Furthermore, we have reported on the program's affordability challenges tied to its uniquely high and growing sustainment-related cost estimates. For example, in 2014 we reported that annual F-35 sustainment costs were estimated to be considerably higher than the combined annual costs of several legacy aircraft, and that DOD had not established sustainment affordability constraints using the services' budgets.[8] Affordability constraints are the amount of financial resources a military service can afford to operate and support a system, like the F-35, given future force budgets and portfolio prioritizations.[9] These constraints then provide a threshold, or cap, for sustainment that cannot be exceeded. We

[6]GAO, *F-35 Joint Strike Fighter: DOD Needs to Update Modernization Schedule and Improve Data on Software Development*, GAO-21-226 (Washington, D.C.: Mar. 18, 2021).

[7]*See*, Related GAO Products page at the end of this statement for a full list of F-35-related reports.

[8]GAO, F-35 *Sustainment: Need for Affordable Strategy, Greater Attention to Risks, and Improved Cost Estimates*, GAO-14-778 (Washington, D.C.: Sept. 23, 2014).

[9]Office of the Secretary of Defense, *Report to Congress on F-35 Joint Strike Fighter Sustainment Affordability and Transparency* (December 2018).

recommended in 2014 that DOD develop affordability constraints linked to the services' budgets. DOD concurred with the recommendation. Subsequently, in October 2018, DOD released sustainment-related affordability constraints based on service budgets and identified the need to substantially reduce the estimated sustainment costs for the program.

Sustainment for the F-35 aircraft is a large and complex undertaking. Key stakeholders include the following:

- **Office of the Undersecretary of Defense (Acquisition and Sustainment) (OUSD (A&S)):** OUSD (A&S) is the Defense Acquisition Executive and oversees the entire acquisition of the F-35, including sustainment and overall costs. OUSD (A&S) also serves as the Milestone Decision Authority for the program.
- **F-35 Joint Program Office:** The F-35 Joint Program Office manages and oversees the support functions required to field and maintain the readiness and operational capability of the F-35 aircraft across the enterprise.
- **Prime Contractor Support:** The F-35 program currently relies heavily on contractors to provide support for its F-35 aircraft. DOD has two primary contractors for the program: Lockheed Martin, for the overall air system, and Pratt & Whitney, for the engine.
- **Military Services:** The Air Force, Navy, and Marine Corps have each established an F-35 integration office or similar construct focused on how the services will operate and afford the F-35, among other things.

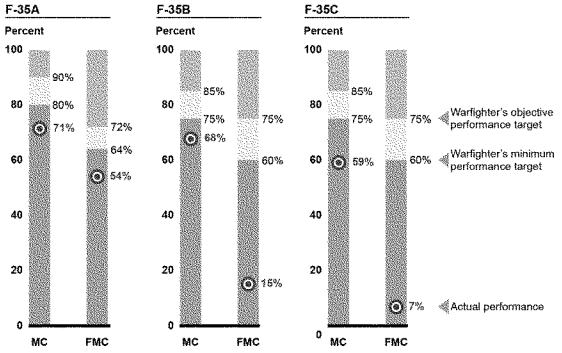
F-35 Mission Capable Rates Have Improved since 2019 but Still Fall Short of Program Goals

We found that the F-35 program has improved the F-35's mission capable rate—the percentage of time during which the aircraft can fly and perform at least one of its tasked missions and full mission capable rate—the percentage of time during which the aircraft can perform all of its tasked missions. Specifically, the U.S. F-35 fleet's average annual:

- mission capable rate increased by 10 percent—from 59 percent in fiscal year 2019 to 69 percent in fiscal year 2020; and
- full mission capable rate improved by 7 percent—from 32 percent in fiscal year 2019 to 39 percent in fiscal year 2020.

Although there have been improvements in both rates, both still fall below the warfighter's minimum and objective performance targets, as shown in figure 2.[10]

Figure 2: U.S. F-35 Fleet Mission Capable and Full Mission Capable Rates, Fiscal Year 2020



Mission Capable (MC): This metric assesses only aircraft that are in the possession of F-35 units. It measures the percentage of time during which these aircraft are safe to fly and able to perform at least one tasked mission.

Full Mission Capable (FMC): This metric assesses only aircraft that are in the possession of F-35 units. It measures the percentage of time during which these aircraft are fully capable of accomplishing all tasked missions.

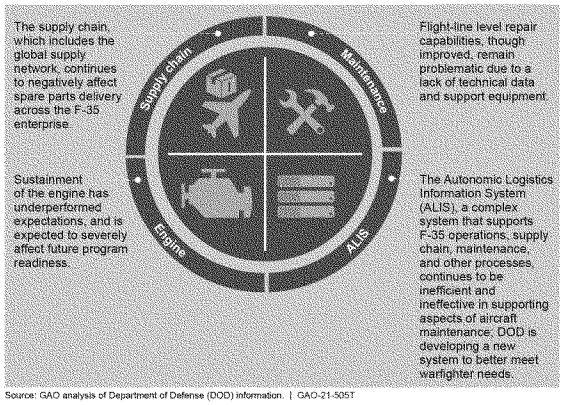
Source: GAO analysis of Department of Defense and Lockheed Martin information. | GAO-21-505T

[10]The warfighter's minimum and objective performance targets are those requirements established by the U.S. Air Force for the F-35A; by the U.S. Marine Corps for the F-35B; and by the U.S. Navy for the F-35C, in their respective Performance Based Arrangements.

F-35 Has Made Progress in Addressing Some Sustainment Challenges, but Significant Issues Continue to Affect Aircraft Readiness

The F-35 program and the services have made progress in addressing sustainment challenges we reported in our prior work, leading to improvements in performance.[11] However, we found that these challenges continue to affect F-35 sustainment operations and aircraft readiness. As described in figure 3, the significant challenges are as follows: (1) the supply chain; (2) maintenance; (3) Autonomic Logistics Information System (ALIS)—a complex system that supports F-35 operations, mission planning, supply-chain management, maintenance, and other processes; and (4) the F-35 engine.

Figure 3: Significant Sustainment Challenges for the F-35 Program



Source: GAO analysis of Department of Defense (DOD) information. | GAO-21-505T

[11]GAO, *Weapon System Sustainment: DOD Needs a Strategy for Re-Designing the F-35's Central Logistics System*, GAO-20-316 (Washington, D.C.: Mar. 6, 2020); GAO, *F-35 Aircraft Sustainment: DOD Needs to Address Substantial Supply Chain Challenges*, GAO-19-321 (Washington, D.C.: Apr. 25, 2019); GAO, *F-35 Aircraft Sustainment: DOD Needs to Address Challenges Affecting Readiness and Cost Transparency*, GAO-18-75 (Washington D.C.: Oct. 26, 2017); and GAO-14-778.

The F-35 Supply Chain Has Become More Responsive, but Challenges Remain

Since we reported on the F-35 supply chain in 2019, we have found that the F-35 program has made improvements in three areas: spare parts availability, customer wait time, and depot-level repair.[12] However, while the program has made improvements, it continues to not meet its objectives in each of those areas.

First, spare parts availability improved over the course of fiscal years 2019 and 2020. Specifically, non-mission capable due to supply rates—the percentage of time during which the aircraft in F-35 units' possession are unable to fly or conduct any of their tasked missions due to a lack of spare parts—improved from an average of 24 percent in fiscal year 2019 to an average of 16 percent in fiscal year 2020. The program office stated that the program plans to fund only enough spare parts to achieve an approximately 15 percent non-mission capable due to supply rate. Given that the Air Force's objective performance target for the mission capable rate in fiscal year 2020 was 90 percent for the F-35A, and that mission capable rate is determined by subtracting the percentage of time during which the aircraft is not available due to issues pertaining to supply and maintenance, having a non-mission capable due to a supply rate of 15 percent categorically makes it impossible to achieve the F-35A's target.

Second, DOD decreased customer wait times for parts and achieved five of its eight customer wait time metrics in fiscal year 2020. This was an improvement from calendar year 2018, when DOD achieved just three of eight customer wait time metrics. However, customer wait times for parts outside of the United States remain problematic. In April 2019 we reported that fewer than 20 percent of critical parts outside of the continental United States were received within 6 days of request—well below the fleet-wide minimum target of 60 percent.[13] This metric still remained well below the 60 percent target in 2020; however, it did improve to 41 percent.

Finally, the inability of the F-35 program to keep up with repair demands has been a recurring issue. As we reported in April 2019, average depot-level repair times were double the program's objective, leading to a significant impact on aircraft readiness.[14] As of August 2020, average repair times improved to 131 days, from 188 days in November 2018;

[12]GAO-19-321.

[13]GAO-19-321.

[14]GAO-19-321.

however, this figure remains well above the program's 60-90 day program objective. According to program officials, part repair times continue to lag because the depots do not yet have the capacity to meet program repair time goals, and they are years away from having sufficient capacity to achieve these goals.

As a result of supply chain challenges, all 11 F-35 locations that responded to our survey reported negative effects on the readiness or capabilities of their aircraft. Specifically, six of the 11 locations reported that parts failed to arrive on time, or that fewer spare parts arrived than were required. As a result, locations were unable to plan for both daily flying operations and aircraft maintenance.

Maintenance Challenges Continue to Affect Aircraft Readiness

We found that the non-mission capable due to maintenance rate—the percentage of time during which aircraft in F-35 units' possession are unable to fly or conduct any of their tasked missions due to a maintenance requirement—decreased from 17 percent in fiscal year 2019 to 16 percent in fiscal year 2020. However, the warfighter's objective performance targets for the mission capable rate in fiscal year 2020 were 90 percent for the F-35A and 85 percent for the F-35B and F-35C. Given that the mission capable rate is determined by subtracting the percentage of time during which the aircraft is not available due to maintenance and supply issues, a non-mission capable due to maintenance rate of 16 percent makes it impossible to achieve any of the F-35 variants' targets.

DOD officials and all 11 F-35 locations that responded to our survey told us that maintenance challenges are still affecting aircraft performance. In particular, they identified two specific challenges, described in detail below: (1) flight line maintainers lack access to technical data to conduct certain maintenance activities; and (2) locations lack support equipment to conduct maintenance efficiently.

Technical data. Technical data, which include the details about how the aircraft should perform and how to maintain its continued performance, constitute an important part of F-35 maintenance.[15] In September 2014 we reported that DOD lacked access to proprietary technical data that could help promote contractor competition or support organic (i.e.,

[15]"Technical data" refers to recorded information (regardless of the form or method of the recording) of a scientific or technical nature (including computer databases and computer software documentation) (see 41 U.S.C. 116). Federal Acquisition Regulation (FAR), 48 C.F.R. § 27.403.

government-operated) sustainment operations, such as maintenance activities.[16] We recommended that DOD develop an Intellectual Property strategy to identify the current levels of the federal government's technical data rights ownership, as well as all critical technical data needs and their associated costs. As of February 2021, DOD was developing but had not yet completed an Intellectual Property strategy for the program. Seven of the 11 locations reported that having accessible technical data remains a challenge directly affecting aircraft availability and operations.

Support equipment. Service officials and F-35 locations also pointed to a lack of support equipment—equipment items that are required to support the operation and maintenance of the aircraft—as a primary driver of maintenance challenges. According to officials who represented five of 11 locations, maintainers lack sufficient support equipment, such as defueling kits or power tools, thus delaying aircraft maintenance. The maintainers attributed the lack of support equipment both to the program not knowing how much support equipment is needed at individual locations, and to the contractors not producing enough support equipment to fully support ongoing operations. The lack of support equipment leads to delays in the required maintenance and to a decrease in the readiness of the aircraft.

ALIS Challenges Persist as the Program Begins Transition to a New System

ALIS is intended to provide the necessary logistics tools for F-35 program participants to operate and sustain the aircraft.[17] However, we have previously identified numerous long-standing issues with ALIS, including that the system is not user-friendly and does not provide the sustainment-related capabilities that were promised.[18] In March 2020 we reported, among other things, that inaccurate and/or missing data in ALIS have at times resulted in the system's signaling that an F-35 aircraft should not be flown—even though the aircraft had no issues that required it to be grounded, and was ready for flight.[19]

[16]GAO-14-778.

[17]ALIS consists of multiple software applications designed to support different squadron activities, such as supply chain management, maintenance, training management, and mission planning.

[18]GAO-14-778; and GAO, *F-35 Sustainment: DOD Needs a Plan to Address Risks Related to Its Central Logistics System*, GAO-16-439 (Washington, D.C.: Apr. 14, 2016).

[19]GAO-20-316.

In our draft report, we found that 10 of the 11 F-35 locations we surveyed reported ongoing issues with several of the ALIS-related challenges we have raised in the past, including data related to aircraft parts. Certain F-35 parts have an associated electronic record that is used to track the remaining time before the part must be replaced, among other things.[20] These electronic records reside within ALIS and are supposed to alert maintainers when parts need to be replaced; however, incorrect, missing, or corrupt electronic records within ALIS continue to affect day-to-day operations on the flight lines. This situation has resulted in the unnecessary grounding of "healthy" F-35 aircraft, as well as a culture of otherwise unnecessary manual workarounds to circumvent the electronic records problem at the squadron level.[21]

Recognizing the ongoing challenges with ALIS, in January 2020 DOD began taking steps to replace it with a future system—the F-35 Operational Data Integrated Network (ODIN). In our March 2020 report we recommended that DOD develop and implement a strategy for the re-design of ALIS to address a myriad of technical and programmatic uncertainties surrounding the development of ODIN.[22] DOD concurred with our recommendation. However, DOD has not yet finalized its strategy for ODIN, including how and when it will address several of the technical and programmatic uncertainties we raised in March 2020. DOD will continue to rely on ALIS to serve as its primary logistics system while the F-35 Joint Program Office continues to focus on completing the strategy for the development and eventual rollout of ODIN.

Problems with Engine Sustainment Are Affecting the Program and Could Significantly Affect Future F-35 Mission Capable Rates

According to multiple service and program officials, challenges related to F-35 engine sustainment are currently affecting the program and may pose its greatest sustainment risk over the next 10 years. At the end of 2020, the program had 20 aircraft unable to fly because they needed engine repairs, according to program officials. In January 2021 the F-35 Joint Program Office projected that the program would have a deficit of approximately 800 engines by 2030 without the implementation of

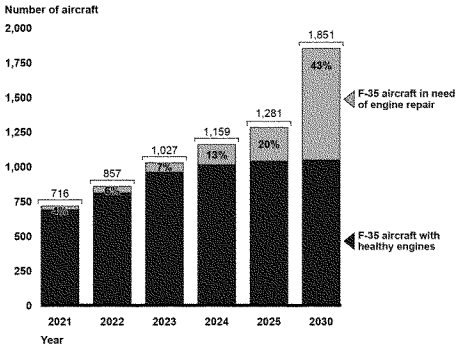
[20]Electronic Equipment Logbooks are electronic files assigned to certain parts that include information such as part history and remaining life (hours). For the purposes of this statement, Electronic Equipment Logbooks are referred to as "electronic records."

[21]GAO testified before the House Oversight and Reform Committee on the Autonomic Logistics Information System and the ongoing issue of Electronic Equipment Logbooks in July 2020. *F-35 Sustainment: DOD Needs to Address Key Uncertainties as It Re-Designs the Aircraft's Logistics System,* GAO-20-665T (Washington, D.C.: July 22, 2020).

[22]GAO-20-316.

considerable mitigation actions, as shown in figure 4. A deficit of this size could lead to 43 percent of the total F-35 fleet being grounded in 2030.

Figure 4: Projected F-35 Aircraft Needing Engine Repairs



Source: GAO analysis of Joint Program Office data. | GAO-21-505T

We found that two main factors contributed to 20 F-35 aircraft needing engine repairs. First, F-35 squadrons removed engines for unscheduled maintenance more often than expected, primarily to repair the power module—a key component of the engine that generates thrust for the aircraft to fly.[23] Specifically, in 2020 the F-35 Joint Program Office projected 52 power module removals, but it experienced 67. Second, the F-35 program was able to repair only 43 percent of removed power modules in 2020, thereby resulting in a backlog of power modules needing repair.[24] The program planned for Oklahoma City Air Logistics Complex—a key source of engine repairs—to repair 90 percent of the

[23]The engine in the F-35A and F-35C has four modules: fan, power, augmenter, and nozzle. The engine in the F-35B has an additional module—the lift fan. The power module includes a compressor, combustor, and two turbines, and it is considered the hottest part of the engine with the smallest rotational parts and some of the tightest tolerances, according to a DOD official.

[24]The 43 percent represents the total number of repaired power modules in 2020 divided by the total number of removed power modules (in need of repair) in 2020.

program's total of removed power modules in 2020. However, according to program officials, Oklahoma City Air Logistics Complex was able to repair only 23 percent of what the program had originally forecasted for the site in 2020.[25] The F-35 Joint Program Office attributed this shortfall to numerous challenges, such as:

- more extensive maintenance being required on the engine module than expected;
- the fact that available technical data did not support the more extensive maintenance being required;
- inefficient maintenance processes and a lack of available support equipment to conduct the more extensive maintenance; and
- a lack of proficiency in the depot workforce.

These challenges resulted in the program's not meeting its goals for engine module repair turnaround time. As of October 2020, the depot had an average repair time of 207 days for a power module—far greater than its turnaround time goal of 122 days. The officials reported that, consequently, the program ended 2020 with a backlog of 65 power modules awaiting repair—a number that had decreased by one, to 64, as of mid-February 2021.

In addition, we found that scheduled engine removals are projected to increase the number of power modules needing repair beginning in late fiscal year 2021. Scheduled engine removals are planned periodic maintenance, based on the number of flying hours, requiring an overhaul of the engine power module as well as other maintenance. An increasing number of scheduled engine removals will further strain the capacity of depots, which are currently struggling to handle the workload associated with repairing the engine power module from the unscheduled engine removals. This capacity issue will lead to an increasing number of aircraft being non-mission capable due to the lack of power modules, as shown previously in figure 4.

DOD recognizes that it lacks the capacity to make both unscheduled and scheduled engine power module repairs at the levels needed to support

[25]According to program officials, engines are repaired at a heavy maintenance center located at Oklahoma City Air Logistics Complex and other contractor facilities in the repair network. Those other contractor facilities repaired 15 power modules in 2020. The heavy maintenance center at Oklahoma City Air Logistics Complex is a public-private partnership between Pratt & Whitney and the U.S. government.

the F-35 program. As a result, DOD is taking steps to increase its depot repair capacity for the power module. However, in the near term, capacity challenges at depots will continue to contribute to the number and percentage of non-mission capable aircraft. The program's current goal is for propulsion-related challenges to account for no more than 4 percent of the program's overall non-mission capable due to supply rate. However, projections have the program exceeding that percentage by the end of fiscal year 2021. Achieving the program's 4 percent goal will depend upon the program's ability to address the various challenges in sustaining the engine. We have an ongoing review focused on DOD's plans to address F-35 engine sustainment challenges, and we plan to report on these issues later in 2021. Therefore, in our draft report, we did not make recommendations concerning F-35 engine sustainment.

F-35 Life Cycle Sustainment Cost Estimates Continue to Rise, and DOD Has Not Made Progress in Meeting Its Affordability Constraints

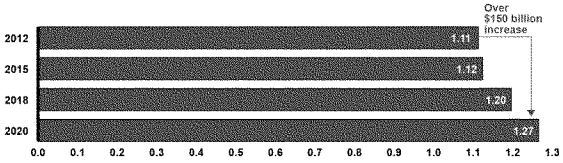
F-35 life cycle sustainment cost estimates continue to increase. We found that a substantial gap exists between estimated operating and support costs for the F-35 and service-established affordability constraints—i.e., operating and support costs the services can afford based on their projected budgets and other priorities. Within DOD there are differing perspectives as to the best course of action, and the program lacks a strategic approach for ensuring that the services can afford to operate and support the F-35. We found that it will become more difficult to reduce sustainment costs as the fleet of F-35 aircraft grows, thus necessitating urgency in addressing significant concerns about the services' ability to afford the long-term sustainment costs of the F-35 program.

Estimated F-35 Life Cycle Sustainment Costs Have Increased by $150 Billion since 2012

Since 2012, sustainment-related cost estimates for the life cycle of the F-35 program have steadily increased, as depicted in figure 5. The F-35 program's latest cost estimate, issued by the Secretary of Defense's CAPE, projects overall sustainment (i.e., operating and support) costs for the program to be about $1.3 trillion through the program's life cycle.[26]

[26]CAPE's 2020 ICE issuance was submitted in accordance with statutory requirements in the National Defense Authorization Act for Fiscal Year 2020. The F-35 program has two additional cost estimates: the F-35 Joint Program Office's Annual Cost Estimate, and the Joint Service Cost Position. These figures, both released in June 2020, estimated total O&S costs for the program. Both produced total O&S costs and cost elements that were very similar to the CAPE O&S estimate.

Figure 5: Growth in F-35 Life Cycle Sustainment Cost Estimates



Source: GAO analysis of Department of Defense data. | GAO-21-505T

[a]Then-year dollars include the effects of inflation.

DOD Has Set Affordability Constraints for F-35 Sustainment Costs, but Its Cost Estimates Project Sustainment Cost Overruns

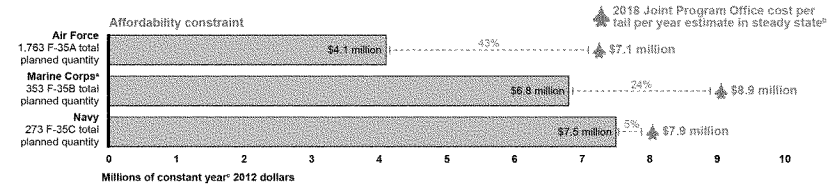
For Major Defense Acquisition Programs like the F-35, affordability constraints are developed by the military services based on the assumptions about the total funding available to them over the life cycle of the given program and projected costs to operate and support other systems in their respective portfolios. In October 2018, in response to a recommendation we made in 2014, the Undersecretary of Defense for Acquisition and Sustainment issued affordability constraints for each of the services.[27] The constraints were established in a cost per tail per year metric, as shown in figure 6.[28] To achieve the constraints, the Air Force, Marine Corps, and Navy determined that, based on F-35 Joint Program Office cost per tail per year estimates, they would need to reduce projected F-35 sustainment costs by 43 percent (or $3.0 million per tail per year), 24 percent (or $2.1 million per tail per year), and 5 percent (or $0.4 million per tail per year), respectively, by the steady state time frame for each variant.[29]

[27]GAO-14-778.

[28]Cost per tail per year is defined as the average annual operating and support cost per aircraft (tail) in a given fleet. It is generally estimated by dividing total operating and support costs of an aircraft fleet by the total number of aircraft.

[29]According to program officials, the steady state period for each service is the period in which it intends to be operating the F-35 at its maximum capabilities. Steady state years for the F-35 program are defined in each respective service's affordability analysis as follows: U.S. Air Force/F-35A – 2036-2041; U.S. Marine Corps/F-35B – 2033-2037; U.S. Navy/F-35C – 2036-2043.

Figure 6: Differences between Service F-35 Affordability Constraints and 2018 Cost Estimates for Annual Sustainment Costs, per Aircraft, at Program Steady State



Source: GAO analysis of Joint Program Office data. | GAO-21-505T

[a]The Marine Corps plans to procure 67 F-35C aircraft in addition to the 353 F-35B aircraft. These 67 F-35C aircraft have the same $6.8 million affordability constraint associated with them; however, since these aircraft were not specifically referenced in the October 2018 F-35 Lighting II Joint Strike Fighter Acquisition Decision Memorandum, we did not include them in the graphic.

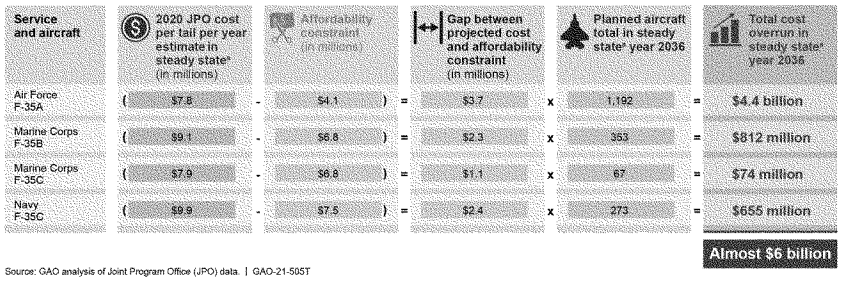
[b]Steady state years for the F-35 program are defined in each respective service's affordability analysis as follows: U.S. Air Force/F-35A – 2036-2041; U.S. Marine Corps/F-35B – 2033-2037; U.S. Navy/F-35C – 2036-2043.

[c]Constant-year dollars are expressed as the value of a specific year and do not include escalation or inflation.

In 2020 the F-35 Joint Program Office updated its cost per tail per year estimates. The estimated annual costs for all three F-35 variants increased, thereby furthering the gap between the affordability constraints established in 2018 and the projected sustainment costs at steady state. Specifically, the Air Force, Marine Corps, and Navy, based on the updated F-35 Joint Program Office estimates, will need to reduce projected F-35A sustainment costs by 47 percent (or $3.7 million per tail per year), 26 percent (or $2.3 million per tail per year for the F-35B), and 24 percent (or $2.4 million per tail per year), respectively, by the steady state time frame for each variant.

Furthermore, as shown in figure 7, based on these updated estimates, we found that the Air Force, Marine Corps, and Navy collectively face annual multi-billion dollar gaps between the projected costs to sustain their respective F-35 fleets at steady state and their stated affordability goals. For example, we found that in steady state year 2036 alone, the Air Force, which projects that it will own 1,192 F-35A aircraft at that time, will need to pay $4.4 billion more than it projects it can afford to sustain those aircraft.

Figure 7: Differences between Service F-35 Affordability Constraints and 2020 Cost Estimates for Annual Sustainment Costs, per Aircraft, at Program Steady State



Source: GAO analysis of Joint Program Office (JPO) data. | GAO-21-505T

Note: Costs are in constant-year 2012 dollars as that was the year when the F-35 program was most recently re-baselined. Constant-year dollars are expressed as the value of a specific year and do not include escalation or inflation. We used Total Aircraft Inventory, which does not account for aircraft attrition, to calculate the planned aircraft totals in steady state year 2036.

[a]Steady state years for the F-35 program are defined in each respective service's affordability analysis as follows: U.S. Air Force/F-35A – 2036-2041; U.S. Marine Corps/F-35B – 2033-2037; U.S Navy/F-35C – 2036-2043. We used 2036 for our calculations, as that year fell within each service's steady state time frame.

DOD recognizes the critical need to reduce sustainment costs for the program, and the department has undertaken efforts to do so. However, these efforts have produced limited results. In September 2014 we reported that in 2013 DOD had established a Cost War Room—a collaborative group comprising the services, the F-35 Joint Program Office, and contractor personnel—for the purpose of reducing program sustainment costs. Recently renamed the Affordability War Room, the group helps assess and manage cost reduction initiatives from across the F-35 program, including government and industry. The Affordability War Room has reported identifying $68 billion in life cycle cost avoidance through various initiatives since 2013.[30] However, according to several DOD officials, even if all of the $68 billion in cost avoidance was achieved, that would represent only a fraction of the reductions needed to lower the F-35 program's sustainment costs (and achieve the services' affordability constraints).

[30]Cost avoidance does not result in a tangible benefit that lowers current spending, investment, or debt levels; rather, it is an action that avoids incurring costs in the future.

F-35 Stakeholders Hold Differing Perspectives, and DOD Lacks a Strategic Approach to Achieving Its Affordability Constraints

According to DOD officials, all stakeholders—the services, the F-35 Joint Program Office, and the contractors—share responsibility for achieving the services' sustainment affordability constraints. OUSD (A&S), which serves as the F-35 program's oversight authority, is also responsible for ensuring that the overall program is affordable from both a production and a sustainment perspective.[31] According to program officials, although the services receive appropriations from Congress to fund the F-35 program and ultimately set the requirements that drive sustainment-related costs for their respective variants, it is imperative for all stakeholders to work together to achieve affordability for the program. However, we found that the stakeholders held unique and differing perspectives on affordability, as described below.

Air Force: Air Force officials told us that the Air Force will not be able to afford the cost of sustaining the 1,763 aircraft it plans to purchase without dramatic cuts to sustainment costs of the F-35A. Since the aircraft has already passed Milestone B, Air Force officials stated that there is little room left for the program to make significant sustainment-related cost reductions, as the program has already made definitive design decisions and established a maintenance strategy. Air Force officials told us that, as a result, the only remaining options for their meeting the affordability constraints are to reduce the total number of F-35A aircraft they plan to purchase, or to reduce the aircraft's planned flying hours, which would have implications on the force structure and capabilities of the Air Force.

Marine Corps: Marine Corps officials stated that while they do not currently face affordability challenges, they anticipate that affordability will negatively affect F-35B sustainment in the future. According to these officials, they will likely need to re-examine the service-related requirements for the aircraft going forward but are not focused on doing so now. Until the F-35B's cost per tail per year becomes an immediate issue, the Marine Corps will continue to fund reliability and maintainability projects and work with the F-35 Joint Program Office's Affordability War Room to focus on reducing F-35B-related sustainment costs.

Navy: Navy officials stated that while they are aware of the affordability challenges faced by the overall program, they believe that the F-35 Joint Program Office's current efforts on reducing program sustainment costs should be sufficient to meet the Navy's affordability goal of $7.5 million

[31]Oversight is a review activity conducted by the Office of the Secretary of Defense, among others, to determine current status, ascertain whether the law or other intentions of Congress are being followed, or serve as a basis for possible future legislation.

cost per tail per year. Navy officials stated that future cost per tail per year overruns should be resolved through various cost savings initiatives being explored and implemented by the F-35 Joint Program Office's Affordability War Room.

F-35 Joint Program Office: Program office officials told us that for the services to achieve their respective affordability constraints, the F-35 program needs to significantly reduce overall F-35 costs. However, the program office's ability to achieve cost savings is constrained by its obligation to fulfill the services' program requirements. According to program officials, if current requirements remain the same, it may be difficult to realize the cost reductions needed to achieve the services' affordability constraints in the steady state time frame.

OUSD (A&S): OUSD (A&S) officials told us that they do not believe the current cost-savings approach will be sufficient to make the program affordable for the services. OUSD (A&S) officials stated that transitioning the sustainment of the F-35 from a predominantly contractor-managed framework to one managed and conducted by the government (i.e., organic sustainment) could be a primary method for sufficiently reducing sustainment costs to achieve the services' affordability constraints. The current mix of service and contractor personnel, according to these officials, is too expensive, and the government could reduce sustainment costs by utilizing an organic approach to F-35 sustainment.

While F-35 program stakeholders agree that sustainment costs are of concern, we found that there is no clear consensus on what should be done to address those concerns. Given the significant affordability challenge facing the department and the uncertainty on how to address this growing issue, in our draft report we recommended that DOD assess and document its ability to meet the services' affordability constraints with existing or planned cost-reduction efforts, and also assess and document changes in service-related program requirements (e.g., the number of aircraft purchases and flying hours) to achieve cost reductions. Additionally, in our draft report we recommended that DOD develop and document a program-wide plan for achieving the services' affordability constraints, and also develop and document a risk management approach for addressing potential challenges to achieving affordability.

Furthermore, DOD is not required to report periodically to Congress on the progress the department has made in reducing the F-35's sustainment costs and closing the gap between these costs and the services' affordability constraints. As the program grows and matures,

sustainment cost reductions will become more difficult. Therefore, in our draft report we suggest that Congress should consider (1) requiring DOD to report annually on progress made in achieving the services' affordability constraints, including the actions taken and planned to reduce sustainment costs; and (2) making future F-35 aircraft procurement decisions contingent on DOD's progress in achieving its F-35 sustainment affordability constraints.

In summary, since 2012 the F-35 program's sustainment cost estimates have increased by more than $150 billion, and these costs are already preventing the services from reaching their respective readiness objectives. Looking ahead, the gap between projected sustainment costs and what the services say they can afford is on track to widen substantially. Achieving cost reductions of this magnitude—billions of dollars a year, every year—presents a formidable challenge for the program. Without a cohesive, strategic approach on the part of DOD, in tandem with ongoing congressional oversight, DOD may continue to invest resources in a program that the department and the services ultimately cannot afford to sustain.

Chairmen Garamendi and Norcross, Ranking Members Lamborn and Hartzler, and Members of the Subcommittees, this completes my prepared statement. I would be pleased to respond to any questions you may have at this time.

GAO Contact and Staff Acknowledgments

If you or your staff have questions about this testimony, please contact Diana Maurer, Director, Defense Capabilities and Management, at (202) 512-9627 or maurerd@gao.gov. Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this statement. GAO staff who made key contributions to this testimony are John Bumgarner and Alissa Czyz (Assistant Directors), Jeff Hubbard (Analyst-in-Charge), Vincent Buquicchio, Juaná Collymore, Ethan Kennedy, William Lamping, Jennifer Leotta, Amie Lesser, Elizabeth Morris, Terry Richardson, and Cheryl Weissman.

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F-35 Sustainment: DOD Needs to Address Key Uncertainties as It Re-Designs the Aircraft's Logistics System. GAO-20-665T. Washington, D.C.: July 22, 2020.

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Diana Maurer
Director Defense Capabilities and Management
U.S. Government Accountability Office

Diana Maurer is a Director in the U.S. Government Accountability Office's (GAO) Defense Capabilities and Management team, where she currently leads GAO's work overseeing defense sustainment issues. Her recent work includes reviews of the F-35 global supply chain, workforce challenges at military depots, DOD's supply chain management, and software sustainment in major weapon systems. She has testified more than two dozen times before Congressional committees on a variety of issues including national drug control policy, DOJ oversight, FBI's use of facial recognition technology, and various management issues at DHS.

Ms. Maurer was a Director in GAO's Homeland Security and Justice team from 2009-2017, where she led GAO's oversight of the federal prison system; the Secret Service, FBI and other federal law enforcement agencies; DOJ grant programs; the federal courts system; and DHS's efforts to build a unified department. She worked from 2008-2009 as an Acting Director in GAO's Natural Resource and Environment team, where she led work assessing U.S. global nuclear detection programs. From 1993-2007, Ms. Maurer worked in GAO's International Affairs and Trade team, where she led reviews of U.S. efforts to combat international terrorism and proliferation of weapons of mass destruction, U.S. assistance to the former Soviet Union, peacekeeping in the Balkans, and several other international issues. Ms. Maurer began her GAO career in 1990 in GAO's Detroit Regional Office.

Ms. Maurer has an M.S. in national resource strategy from the National Defense University where she was recognized as a Distinguished Graduate of the Industrial College of the Armed Forces. Ms. Maurer also has an M.P.P in international public policy from the University of Michigan and a B.A. in international relations from Michigan State University.

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BY THE HOUSE ARMED SERVICES
SUBCOMMITTEES ON
READINESS AND TACTICAL AIR & LAND FORCES

STATEMENT OF
GREGORY ULMER
EXECUTIVE VICE PRESIDENT
AERONAUTICS
LOCKHEED MARTIN CORPORATION

BEFORE THE
READINESS AND TACTICAL AIR & LAND FORCES SUBCOMMITTEES
HOUSE ARMED SERVICES COMMITTEE
ON
F-35 PROGRAM UPDATE: ACCOMPLISHMENTS, ISSUES, AND RISKS WITHIN THE AREAS OF DEVELOPMENT, PRODUCTION, TESTING, FIELDING, AND SUSTAINMENT ACTIVITIES

APRIL 22, 2021

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READINESS AND TACTICAL AIR & LAND FORCES

1. INTRODUCTION

On behalf of Lockheed Martin and the men and women that run the world's most advanced production line as well as the 13 allies and security partners, the 1,900 global suppliers and small businesses who make up this truly joint strike fighter F-35 Industrial Team, thank you for the opportunity to share the status of the F-35 program and partner with you to support this critical national security program.

This Committee has been instrumental in guiding, overseeing, and championing the F-35. I thank you for the support you have provided and I come before you today with an eagerness to share some extraordinary successes of the F-35 program as well as to transparently discuss areas of needed focus on the program.

If I leave you with three take-aways today, they are that Lockheed Martin is fully invested in:

- Reducing F-35 acquisition and life-cycle costs to create budget trade space for our customers;
- Maintaining the ever-changing and perishable technological "step ahead" of peer threats; and
- Increasing aircraft availability to ensure that this 5th Gen fleet is an ever-ready deterrent for our nation and its allies who operate F-35.

To deliver this affordability, capability, and availability, Lockheed Martin is working across all elements of production, development and modernization applying cutting-edge technology, software development, analytics, and business processes to reduce costs and improve performance. Our employees, and those throughout the supply chain, recognize our responsibility to deliver this weapon system to our warfighters with the most advanced capability and highest readiness levels to keep them safe as they protect our nation.

2. DRIVING AFFORDABILITY THROUGHOUT THE PROGRAM LIFECYCLE

I would like to directly address a major area of concern for our customers and one that Lockheed Martin believes is a focal point in need of sustained attention - operations & support (O&S) costs.

Lockheed Martin is applying the full weight of our talent and ingenuity to root out F-35 sustainment cost drivers. In the last five years, Lockheed Martin invested nearly $400 million dollars to aggressively drive sustainment cost reduction and increase readiness performance – all while scaling the fleet. Our contract actuals demonstrate Lockheed Martin success in reducing 44% our share of Cost per Flying Hour (CpFH) in this time. Further, our proven forecasting models show another ~40% reduction in Lockheed Martin CpFH in the coming five years as ongoing investments with long lead times continue to bear results.

Our O&S affordability drive has a two-fold focus: reduce manpower and material cost. We are decreasing the people required to support and maintain the F-35 by digitally transforming through robotic process automation, streamlining flight-line operations, and establishing a financial structure to decrease sustainment labor rates by more than 20%.

We are concentrated on cost reduction in part by applying cutting-edge analytics and prognostics to improve demand planning and material forecasting and maintenance predictability. We are also instituting reliability and maintainability improvements to keep parts

on the jet longer, executing long-term agreements with key suppliers, and aggregating the total program demand to increase buying power.

We cannot accomplish sustainment affordability alone – we must attack these costs as an integrated enterprise in partnership with our customers. While O&S costs include non-addressable items, of the items we can address as a collective team, Lockheed Martin costs account for ~39% of the total O&S cost of the F-35, with the U.S. Government and Pratt & Whitney accounting for the remainder. Lockheed Martin stands ready to partner with our service customers to drive enterprise-wide affordability while scaling the fleet. We believe the most effective way to achieve these results is to establish long-term sustainment partnerships that eliminate the cumbersome annual contracting process and provide more stability for long-term investment.

Lockheed Martin is a proven entity when it comes to meeting demanding cost milestones on the F-35. We now offer a cutting-edge 5th Gen aircraft at price parity with far-less-capable legacy aircraft – an accomplishment that reflects the true might of government and industry partnering together to solve program challenges. We believe that with applied engineering discipline, focused investments, and updated contracting and management structures, we will deliver similar cost reductions and efficiencies in sustainment to what we have achieved on the production side of the program.

3. DELIVERING ADVANCED CAPABILTY TO OUTPACE ADVANCING THREATS

As we take out cost across the F-35 enterprise, we have not lost sight of our nation's adversaries who are advancing military capabilities at a rate and scale unmatched in the lifetimes of most Americans. Maintaining perishable advantage against these sophisticated, professional militaries requires capability insertion to keep pace with our adversary's technology advancements at a near-constant cadence.

Lockheed Martin met or exceeded all contractual technical capabilities for the Block 3F requirement. Now, to outpace advancing Chinese and Russian technologies, the program is focused on Follow on Modernization (FOM), the advanced capability insertion program to deliver cutting-edge warfighting technologies.

There are two notable dimensions of FOM: Block 4, which is a significant number of highly advanced capabilities and weapons, and Technical Refresh-3, (TR-3) the hardware providing additive processing power, memory, and open systems architecture upon which Block 4 capabilities depend. And while we have made progress on these advancements, both Block 4 and TR-3 need considerable attention – although in different ways.

TR-3 is experiencing cost overruns caused by supplier challenges and COVID impacts. As the prime contractor responsible for this program, Lockheed Martin fully owns this issue and our most senior leadership is tracking these deliverables directly. We have conducted a full TR-3 root cause analysis and instituted a robust remediation plan. In response to this challenge, we recently waived ~$60M in fees in order that those funds can augment TR-3/Block 4 development. And, we have deployed additional engineering and management talent to ensure we remain on the critical path to Lot 15 TR-3 insertion.

Block 4 has been executing to plan but is unfortunately suffering from unexpected delays caused by under-funding. Lockheed Martin is working with our customers to establish sufficient funding to continue integral development activities to advance the F-35's capability and outpace

advancing threats. Block 4 capabilities are in ongoing development cycles and, to stay in front of adversary technological developments, require reoccurring annual funding.

While much progress on the F-35 capability advancement occurs in partnership with our government customers, Lockheed Martin is also advancing and demonstrating several significant capabilities above and beyond that which is required in the performance of a modernization contract.

Lockheed Martin is partnering with our customers to propel the development of sophisticated technologies needed to prosecute peer warfighting against some of the most vexing Chinese and Russian threats. We're investing Lockheed Martin dollars alongside our customer investments to fuel fusion and sensor management for advanced mobile threats, collaborative targeting, external carriage flexibility, advanced weapons integration, and embedded training pathways to Live Virtual Constructive training. We are also developing and demonstrating secure low probability of detect and intercept line-of-sight and beyond-line-of-sight communications using existing apertures, integration with nano satellite mesh networks, fused F-35 sensor information with national ISR data, and proven capability to track ballistic and hypersonic weapons in support of both Joint All Domain Operations (JADO) and Joint All Domain Command and Control (JADC2).

To date, the F-35 has successfully integrated with the Aegis Missile Defense system, a High Mobility Artillery Rocket System (HIMARS), the Integrated Air and Missile Defense Battle Command System (IBCS), and most recently in partnership with the Missile Defense Agency and U.S. Air Force, we successfully connected an F-35, U-2, and a multi-domain ground station. These demonstrate the information advantage of making the F-35's integrated and fused sensor suite available to other airborne, ground, space, surface and even subsurface warfighters.

Lockheed Martin investments are shortening sensor to shooter engagement timelines, increasing high-value target detection, and underpinning JADO. They will offer our commanders the ability to port the F-35's capabilities to the entire Joint Force to enable networked warfighting, or the flexibility to close kill chains organically where threats preclude long-range, multi-platform responses. In either case, they work to provide the lowest cost-per-effect necessary to deter our nation's most sophisticated adversaries.

It is worth noting that these capabilities – along with those being funded by our government customers – are being integrated into a fleet that is present today, in numbers. This tangible and capable fleet weighs heavily in tipping our adversaries' daily calculus against aggression. Should deterrence fail and that calculus change, it is this backbone fleet capacity that will offer the decisive edge to our men and women called into battle against our nation's proficient adversaries.

4. INCREASING AVAILABILITY ACROSS A GROWING FLEET

For the warfighter to achieve their mission we must ensure that there is an ever-ready deterrent. The fact remains that over the last 18 months readiness metrics on F-35 have steadily trended in a positive direction, all this while adding 120 aircraft to the fleet in 2020 and 134 in 2019. The F-35 is proven to be more reliable than 4th Generation aircraft with a mean flight hour between failure (MFHBF) rate - the time that parts remain on the aircraft before needing to be repaired - more than twice that of a 4th Generation weapons system.

Readiness rates continue to rise across the fleet. The U.S. Air Force recently returned from 18 consecutive months in the CENTCOM Aera of Responsibility (AOR) where they flew more than 1,300 sorties, with an average Mission Capable (MC) rate of 73.5% with many periods of time operating at 80% – 90%, and even 100% MC rate at some points.

The fact is that to deliver an initial operational capability, trades were made across the enterprise early in the program, and today we are playing catch up on sustainment. Lockheed Martin is working closely with our customer to accelerate depot activations for 68 repair lines five years ahead of plan. We have completed 32 of the 68 workloads with an additional 11 planned for this year and the balance to be completed and repairing at rate by the end of 2024. Lockheed Martin is also applying the full force of its supply chain to drive down cost by aggregating sustainment demand with production orders and further enabling cost reduction objectives.

Expanding F-35 component repair capacity, in the very near term, is essential to improving readiness. Our Public Private Partnerships (PPP) are enabling Organic Depot repair and are the centerpiece of our success. As the fleet expands and flying hours increase, the demand for repair will outpace the organic depot capacity, and without adding supply chain and international capacity to the repair network, the current component repair backlog will grow. Lockheed Martin is 100% committed to F-35 Public-Private Partnerships (PPP) and Title 10 requirements, and we see these Industry/Depot PPP as a proven win-win strategy for sustainment moving forward.

We have also made significant progress in partnership with our customers on the transition from the Autonomic Logistics Information System (ALIS) to the Operational Data Information Network (ODIN). Our shared goal is continue improving speed, minimizing hardware footprint, reducing required labor, and enhancing user experience and overall capability. We continue to make improvements with each ALIS software update.

We are currently fielding the latest release of ALIS, which includes improvements in Air Vehicle Transfer times now measured in minutes instead of days, workflow and user interface improvements to include a new weapons load page that reduces user burden by 54%, 15 additional Electronic Equipment Logbook (EEL) software fixes, ALIS Windows 7 to Windows 10 migration, and improvements to cyber security based on Joint Operational Test Team assessments. The previous release of ALIS, which completed fielding in November 2020, included a 50% reduction in executing Air Vehicle releases, improved F-35 Portable Memory Device (PMD) download processing by 30%, and also included 50% reduction in manual EELs.

The ALIS and ODIN primary purpose remains the same – to be the F-35's logistics system for maintenance, health/diagnostics, supply chain management, and fleet management; however, ODIN is being led by the JPO and will be developed with current tools and technologies with the aim of improving on the current ALIS system. ODIN will utilize an integrated data environment and cloud-native architecture to support F-35 maintenance actions with the goal of improving maintenance efficiency in addition to inventory management and responsiveness. We are partnering with the JPO on ODIN as demonstrated by the development and successful initial deployment of the ODIN Base Kits. These units, which can run ALIS and ODIN software, are currently being procured and will soon begin wider fielding. The ODIN Base Kit is a significant reduction in the hardware logistics footprint which reduced size by 75% and weight by 90% from the current hardware (SOUv2). In addition to improving the logistics footprint, the ODIN Base Kit delivers significant overall performance improvements including PMD debrief times two times faster than the current hardware, faster screen times, and faster report processing, all of which was validated and documented by the JPO during testing at NAS Patuxent River. In the

meantime, until ODIN is fielded, we remain fully committed to ensuring ALIS meets the needs of the maintainers on the flight line. Working with the JPO, we've established a quarterly software update interval that has enabled far better responsiveness to user needs.

5. INVESTING IN THE AMERICAN WORKFORCE

The F-35 is an investment in American workers, directly employing 67,500+ individuals in high-paying, high-tech jobs, and supporting more than 254,000 jobs across the nation. The more than 1,800 U.S. based suppliers span 48 states and Puerto Rico. Of these, more than half (1,000) are small businesses and/or special category businesses. In total, the F-35 produces an annual economic impact of more than $49 billion – proving once again that the F-35 is a true economic and innovation engine.

The F-35 demonstrates the strength of American manufacturing and is maintaining an integral production workforce in communities across the nation, while advancing key technical skills. The backbone of the F-35 workforce are the thousands of represented employees from the International Association of Machinists and Aerospace Workers (IAM) who represent the most impressive aerospace workforce in the world.

Lockheed Martin has been a champion of suppliers, especially small and vulnerable businesses, during the COVID-19 pandemic. In the first quarter of this year, we averaged more than $430 million weekly in accelerated payments to our supply chain partners, with a focus on small and vulnerable businesses. Since the beginning of the pandemic, we have accelerated payments to more than 11,000 suppliers, including more than 6,700 small businesses across all 50 states.

And it's not just advancing manufacturing skills – the F-35 is a digital enterprise. The program is an incubator of advanced technologies in critical national security fields of artificial intelligence, cyber resilience, robotics, and advanced materials. Our teams are deploying sophisticated business practices that enable cost-effective, open digital advancements and generate state-of-the-art cyber resiliency.

We are reducing design speed and cost with digital representations, incorporating model-based systems engineering to improve design throughput and accuracy, and building integrated and robust DevSecOps tool suites for rapid and responsive software development. To augment a backlog in test capacity, we are advancing computational test to speed capability and weapons onto the jet. Lockheed Martin funds are fueling an industry-leading aeronautics cyber range, factory automation, robotics, and artificial intelligence application across the lifecycle of the program.

The ingenuity of the F-35 workforce is driving American know-how needed to compete on global economic and national security playing fields. Commitment to the F-35 program is critical to the economic health of communities across America and to our nation's high-tech global competitiveness.

6. SUSTAINED PERFORMANCE DURING THE GLOBAL PANDEMIC

Despite widespread COVID-19 impacts on many of our suppliers, we delivered 120 F-35s in 2020. We did this by working with our unions and workforce to institute an alternate work schedule to ensure the safety of our workers and continue to deliver this critical capability to the warfighter.

F-35 is the only active 5th Generation fighter production line with the capacity to produce aircraft in large numbers. Our goal for 2021 is to deliver 133-139 aircraft, depending on the COVID-19 recovery schedules of our suppliers. With additional supply chain capacity, we could deliver up to 189 aircraft per year, accommodating increased ramp rates from the U.S. Services, which we believe is essential to achieving the full program of record and delivering the capability needed for the United States to maintain its competitive advantage around the world.

As we ramp up production with your help, we remain focused on lowering cost, reducing build times, and improving on-time delivery and quality by incorporating lessons learned, process efficiencies, supply chain initiatives, facility investments, and tooling upgrades and more. We continue to invest in and align our manpower, machines, materials, and methods to ensure we meet the growing demand while achieving our cost, quality, and schedule goals.

7. ROLE IN GLOBAL DETERRENCE AND DIPLOMACY

Finally, I want to reinforce the F-35's role in alliance-based deterrence and its growing presence in U.S. global operations. When I testified before this committee in November of 2019, three U.S. Services – the Air Force, Navy and Marine Corps - and five international customers had declared initial operational capability (IOC) - the public declaration that their aircraft are mission ready and combat capable.

And today, F-35s are operating from 27 bases and ships, and 10 nations have now declared their IOC. We have delivered more than 630 aircraft to date with more than 225 currently in production. The program has more than 380,000 accumulated flight hours flying around the world. There are more than 1,300 F-35 pilots and 10,000 maintainers trained on the platform. The F-35 has flown in combat on multiple occasions with U.S. Marine Corps F-35Bs currently deployed supporting two different combat theaters. We also recently celebrated delivery of Denmark's first aircraft marking the 5th NATO nation to fly the aircraft.

President Biden has issued a call to meet accelerating global aggression by rebuilding alliances and leading with diplomacy. With 14 cost-sharing nations, the F-35 program is the largest global cooperative defense development program and a critical security burden-sharing pillar. It represents enormous international commitment with investment in excess of $11B. The U.S. is benefiting from cost burden sharing from common capability development and economies of scale that are the hallmark of the F-35 program.

The aircraft's unprecedented interoperability amplifies deterrence and transforms how the coalition forces train, fight, and win. For example, the U.S and Israel participated in a joint training exercise last year called "Enduring Lightning," Italian and Norwegian F-35s have conducted NATO operational air policing missions and F-35s from the Netherlands are currently involved in the Deviant Dragon exercises in Europe. Current basing plans show nearly 450 F-35s across Europe by 2035, including USAF aircraft stationed in Lakenheath, which will be critical to stabilizing the highly contested Arctic/High North region, and a permanent INDOPACOM presence of more than 220 international F-35s in the region.

The F-35's role in the complex global security environment was recently underpinned by INDOPACOM Nominee Admiral John Aquilino who stated in his Congressional testimony that 5th Generation fighters are required to win in the IndoPacific command area. Additionally, General Wolters, U.S. European Commander, reinforced the need for F-35s in Europe during recent testimony to the Senate Armed Services Committee when he stated "we, in the U.S.,

need F-35s in Europe, …to ensure that we have a competitive advantage necessary to protect our sovereign territory."

As this committee knows, the U.S. cannot 'go it alone' in these expansive regions. Strengthening global F-35 alliances is a cost-effective way to pace the rapidly growing scale of sophisticated adversaries.

8. CONCLUSION

Lockheed Martin appreciates the responsibility we bear to deliver this weapon system for the U.S. and our global customers, and we are deeply committed to the long-term success of the F-35. Maintaining the technological, digital, and industrial competitiveness of the F-35 program will continue to drive Lockheed Martin. We bring a decades-long lens to this program and you can expect that we will continue to put our best talent, ingenuity, and technological focus towards the F-35. We do so with the ambition that we might exceed our customer's expectations and that we might fortify this critical plank in our nation's security both now and many decades into the future.

Strengthening global F-35 alliances provides cost-effective way to pace the rapidly growing scale of sophisticated adversaries. The ability to act as a sensor as well as a shooter creates an unmatched cost per effect for the U.S. military and our allies. With limited defense dollars, the ability to perform multiple functions not only saves taxpayer dollars, but more importantly, saves lives.

We respectfully request your support in ensuring a stable funding for the modernization efforts, and demanding a partnership to attack sustainment costs from an enterprise perspective, while maintaining the ramp rate toward full rate production so that together we can truly deliver on the value proposition of this critically important national security program.

Again, I thank you for the opportunity to represent the men and women of Lockheed Martin and the industry team who take great pride in providing the world's most advanced fighter to our servicemen and women. And I thank you for your continued support of this vital weapons system and the service men and women who fly, maintain, and support them.

Gregory M. Ulmer
Vice President and General Manager F-35 Program
Lockheed Martin Aeronautics Company

Greg Ulmer is Vice President and General Manager, F-35 Lightning II Program, at Lockheed Martin Aeronautics Company. In this role, Mr. Ulmer leads all areas of the F-35 Lightning II fighter aircraft program, to include development, production, sustainment and modernization supporting three F-35 aircraft variants for three U.S. military services, eight international partner nations, and multiple foreign military sales customers.

Prior to this position, Mr. Ulmer was Vice President, F-35 Aircraft Production Business Unit for more than two years, responsible for all aspects of global F-35 production and delivery to include program management, production operations, supply chain management, quality, affordability, tooling and manufacturing rate readiness and customer engagement.

Mr. Ulmer formally held the position of Vice President of Operations for Advanced Development Programs (ADP), also known as the Skunk Works®, located at Lockheed Martin Aeronautics in Palmdale, California. In this role, he was responsible for the ADP operations comprised of more than 3,000 employees across multiple Aeronautics sites overseeing the F-22 Raptor Modification Line, U-2 Dragon Lady Periodic Depot Maintenance, F-35 Lightning II sub-assembly work and ADP Special Programs.

Previously, Mr. Ulmer was the C-5 Vice President and Program Manager responsible for the overall operations and leadership of the C-5 Reliability Enhancement and Re-Engining Program and the Avionics Modernization Program at Lockheed Martin Aeronautics in Marietta, Georgia. In this role, he also had overall leadership for C-5 legacy fleet sustainment, to include depot services, block upgrades, unscheduled depot level maintenance, and the Large Aircraft Infrared Countermeasures program.

Throughout his career, Mr. Ulmer has established a diverse aviation background in commercial aviation, tactical and strategic airlift, ISR and fighter aircraft. Earlier career leadership roles include service as the C-130 Deputy Program Manager for Operations; C-130 Air Vehicle Director; Deputy Chief Engineer and Flight Test Integrated Product Team (IPT) Senior Manager and more. Mr. Ulmer began his career as a flight test engineer supporting the MD-11, C-17, and C-130J programs from first flight through certification for all three air vehicles.

Mr. Ulmer graduated from California Polytechnic State University in San Luis Obispo, California, with a bachelor's degree in Aeronautical Engineering. He also holds an executive master's degree in Business Management with an emphasis on aerospace from the University of Tennessee.

Greg and his wife Shawnie reside in Fort Worth, Texas.

August 2018

DISCLOSURE FORM FOR WITNESSES
COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES

INSTRUCTION TO WITNESSES: Rule 11, clause 2(g)(5), of the Rules of the House of Representatives for the 117th Congress requires nongovernmental witnesses appearing before House committees to include in their written statements a curriculum vitae and a disclosure of the amount and source of any federal contracts or grants (including subcontracts and subgrants), and contracts or grants (including subcontracts and subgrants), or payments originating with a foreign government, received during the past 36 months either by the witness or by an entity represented by the witness and related to the subject matter of the hearing. Rule 11, clause 2(g)(5) also requires nongovernmental witnesses to disclose whether they are a fiduciary (including, but not limited to, a director, officer, advisor, or resident agent) of any organization or entity that has an interest in the subject matter of the hearing. As a matter of committee policy, the House Committee on Armed Services further requires nongovernmental witnesses to disclose the amount and source of any contracts or grants (including subcontracts and subgrants), or payments originating with any organization or entity, whether public or private, that has a material interest in the subject matter of the hearing, received during the past 36 months either by the witness or by an entity represented by the witness. Please note that a copy of these statements, with appropriate redactions to protect the witness's personal privacy (including home address and phone number), will be made publicly available in electronic form 24 hours before the witness appears to the extent practicable, but not later than one day after the witness's appearance before the committee. Witnesses may list additional grants, contracts, or payments on additional sheets, if necessary. Please complete this form electronically.

Hearing Date: April 22, 2021

Hearing Subject:

Update on F-35 Program Accomplishments, Issues, and Risks

Witness name: Gregory M. Ulmer

Position/Title: Executive Vice President, Lockheed Martin Aeronautics

Capacity in which appearing: (check one)

○ Individual ● Representative

If appearing in a representative capacity, name of the organization or entity represented:

Lockheed Martin Corporation

Federal Contract or Grant Information: If you or the entity you represent before the Committee on Armed Services has contracts (including subcontracts) or grants (including subgrants) with the federal government, received during the past 36 months and related to the subject matter of the hearing, please provide the following information:

2021

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00019-19-G-0008 N0001921F0167	U.S. Navy	3,716,538	ALIS Q2 ROLLOUT
N00019-19-G-0008 N0001921F0073	U.S. Navy	1,989,843	ALIS PMA UPGRADES
N00019-19-G-0008 N0001921F0084	U.S. Navy	1,886,273	F-35 LOT 13 DCA
N00019-19-G-0008 N0001921F0222	U.S. Navy	1,877,288	AU LO MANAGEMENT
N00019-19-G-0008 N0001921F0168	U.S. Navy	1,481,619	ISRAEL BLOCK 4

2020

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00019-20-C-0006	U.S. Navy	1,906,122,850	FY20 ANNUALIZED SUSTAINMENT
N00019-21-C-0020	U.S. Navy	1,289,946,184	FY21 ANNUALIZED SUSTAINMENT 6-MONTH UCA
N00019-20-C-0032	U.S. Navy	935,530,602	FY 20/21 SITE ACTIVATION & HARDWARE (SAHW)
N00019-20-C-0037	U.S. Navy	557,665,273	DEVELOPMENT FOUNDATION CONTRACT (DFC) II
N00019-19-D-0015 N00019-20-F-0606	Defense Contract Management Agency	393,453,792	LOT 14 AND FY20 AME/PFE

2019

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00019-20-C-0009	U.S. Navy	2,702,107,148	LOW RATE INITIAL PRODUCTION LOT 15
N00019-19-C-1022	U.S. Navy	1,158,087,730	FY19 ANNUALIZED
N00019-19-D-0015 N0001919F2698	Defense Contract Management Agency	530,212,325	FY19 SPARES/ LOT 13 AME/PFE MATERIAL REQUIREMENTS
N00019-19-C-0074	U.S. Navy	419,596,684	SPECIAL TOOLING AND TEST EQUIPMENT (STATE)
N00019-19-D-0015 N0001919F4207	Defense Contract Management Agency	374,069,824	FY19 SPARES - ASP/DSP REQUIREMENTS

2018

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00019-19-C-0010	U.S. Navy	2,292,885,305	C2D2 F-35 FOM PHASE 2.3
N00019-18-C-1048	U.S. Navy	1,928,059,496	LOW RATE INITIAL PRODUCTION 11 NON-ANNUALIZED
N00019-14-G-0020 N0001919F2474	U.S. Navy	1,023,344,845	TR3 PHASE 3
N00019-19-C-0004	U.S. Navy	388,979,728	DEVELOPMENT FOUNDATION CONTRACT (DFC)
N00019-14-G-0020 N0001918F0472	U.S. Navy	352,280,611	LRIP 12 AME/PFE

Foreign Government Contract, Grant, or Payment Information: If you or the entity you represent before the Committee on Armed Services has contracts or grants (including subcontracts or subgrants), or payments originating from a foreign government, received during the past 36 months and related to the subject matter of the hearing, please provide the following information:

2021

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
CASG/ASD/CON/12985/1	AUSTRALIAN GOV,DEPT OF DEFENCE,AUSTRALIA	66,569,269	LM AUS TRAINING SUPPORT SERVICES

2020

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
LPT/50164	MINISTRY OF DEFENCE - UNITED KINGDOM	2,247,269	SF ENABLING WORKS
BELGIUM ESI PROGRAM BELGIUM ESI 012 FER	GOVERNMENT OF BELGIUM	3,575,000	BELGIUM ESI 012 IMPLEMENTATION AGRMT - FERONYL ETC
BELGIUM ESI PROGRAM BELGIUM ESI 018 UCS	GOVERNMENT OF BELGIUM	100,000	BELGIUM ESI 018 IMPLEMENTATION AGRMT - SOLVAY UCS

2019

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
CASG/JSF/CON10869/2	AUSTRALIAN GOV,DEPT OF DEFENCE,AUSTRALIA	92,601,644	LM AUS IMAS STAFFING
PO 4440969646	MIN OF DEFENSE, GOVT OF ISRAEL	50,750,000	ISRAEL TRAINING CENTER PO - OCONUS
CASG/JSF/CONTRACT048	AUSTRALIAN GOV,DEPT OF DEFENCE,AUSTRALIA	43,949,097	LM AUS DDMS
PO 4441017193	MIN OF DEFENSE, GOVT OF ISRAEL	7,500,000	ISRAEL TRAINING CENTER PO – CONUS
PO 4440998899	MIN OF DEFENSE, GOVT OF ISRAEL	417,000	ISRAEL ICS

2018

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
PO 4440908383	GOVERNMENT OF ISRAEL	1,677,792	MITIGATION OCONUS PO
PO 4440916575	MIN OF DEFENSE, GOVT OF ISRAEL	180,000	MITIGATION CONUS PO

Fiduciary Relationships: If you are a fiduciary of any organization or entity that has an interest in the subject matter of the hearing, please provide the following information:

Organization or entity	Brief description of the fiduciary relationship
N/A	N/A

Organization or Entity Contract, Grant or Payment Information: If you or the entity you represent before the Committee on Armed Services has contracts or grants (including subcontracts or subgrants) or payments originating from an organization or entity, whether public or private, that has a material interest in the subject matter of the hearing, received during the past 36 months, please provide the following information:

2021

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
N/A	N/A	N/A	N/A

2020

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment

2019

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment

2018

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment

Lockheed Martin Aero JSF USG Contracts

2021 (1/1/21 - 4/15/21)

Federal Grant / Contract Number	Federal Agency / Prime Contract Awarding Agency	Dollar Value	Subject of Contract / Contract Title
N00019-19-G-0008 N0001921F0167	U.S. Navy	3,716,538.00	ALIS Q2 ROLLOUT
N00019-19-G-0008 N0001921F0073	U.S. Navy	1,989,843.00	ALIS PMA UPGRADES
N00019-19-G-0008 N0001921F0084	U.S. Navy	1,886,272.85	F-35 LOT 13 DCA
N00019-19-G-0008 N0001921F0222	U.S. Navy	1,877,288.00	AU LO MANAGEMENT
N00019-19-G-0008 N0001921F0168	U.S. Navy	1,481,618.93	ISRAEL BLOCK 4
N00019-19-G-0008 N0001921F0353	U.S. Navy	1,389,928.00	NEXT GENERATION THREAT SYSTEM (NGTS) PHASE 1
N00019-19-G-0008 N0001921F0153	U.S. Navy	821,658.00	ISRAEL DEPOT ACTIVATION
N00019-19-G-0008 N0001921F0322	U.S. Navy	517,370.00	CAMERI DEPOT EXPANSION
N00019-19-G-0008 N0001921F0052	U.S. Navy	190,334.00	UK AIRWORTHINESS
N00019-19-G-0008 N0001921F0307	U.S. Navy	40,851.00	NORWAY ENCRYPTION
N00019-19-G-0008 N0001921F0340	U.S. Navy	12,437.00	UK WINGRIP
N00019-20-D-0109 N00019-21-F-0371	U.S. Navy	7,181.00	GFE IDIQ - AS25 LRU REPLACEMENT

2020

Federal Grant / Contract Number	Federal Agency / Prime Contract Awarding Agency	Dollar Value	Subject of Contract / Contract Title
N00019-20-C-0006	U.S. Navy	1,906,122,850.17	FY20 ANNUALIZED SUSTAINMENT
N00019-21-C-0020	U.S. Navy	1,289,946,184.00	FY21 ANNUALIZED SUSTAINMENT 6-MONTH UCA
N00019-20-C-0032	U.S. Navy	935,530,602.00	FY 20/21 SITE ACTIVATION & HARDWARE (SAHW)
N00019-20-C-0037	U.S. Navy	557,665,273.01	DEVELOPMENT FOUNDATION CONTRACT (DFC) II
N00019-19-D-0015 N00019-20-F-0606	Defense Contract Management Agency	393,453,792.00	LOT 14 AND FY20 AME/PFE
N00019-19-G-0008 N0001920F0571	U.S. Navy	349,688,545.50	CY20-22 MODIFICATIONS AND UPGRADES
N00019-19-D-0015 N0001920F0785	Defense Contract Management Agency	299,235,209.31	FY20 INITIAL SPARES
N00019-19-G-0008 N00019-20-F-0565	U.S. Navy	136,450,799.68	LRIP 6-14 KNOWN -LRIP 6-11 UNKNOWN ISSUES CONTRACT
N00019-19-D-0015 N00019-20-F-0579	Defense Contract Management Agency	115,782,307.00	HELMETS LOT 14
N00019-19-G-0008 N00019-20-F-0443	U.S. Navy	109,913,781.00	DMS REDESIGN
N00019-19-G-0008 N0001920F0377	U.S. Navy	98,948,397.00	NEXT GEN EODAS
N00019-19-G-0008 N00019-20-F-0817	U.S. Navy	32,015,586.00	LOT 12 DMS MANAGEMENT

N00019-20-C-0052	U.S. Navy	31,795,354.00	NORWAY ITALY REPROGRAMMING LABORATORY SUSTAINMENT
N00019-20-C-0048	U.S. Navy	22,902,038.00	BELGIUM INTEGRATION CONTRACT
N00019-19-G-0008 N0001920F0078	U.S. Navy	20,630,000.00	30P05 FIELDING CONTRACT
N00019-19-G-0008 N00019-20-F-0022	U.S. Navy	18,997,184.00	DMS INTEL #2
N00019-19-G-0008 N0001920F0532	U.S. Navy	18,342,170.00	CY20-21 INITIAL SPARES LABOR
N00019-20-D-0007 N0001920F0238	U.S. Navy	13,004,845.00	ODIN HW TEST & DEPLOYMENT
N00019-20-D-0007 N0001920F0183	U.S. Navy	6,129,390.00	AIR VEHICLE DATA & HEALTH (AVDH)
N00019-19-G-0008 N00019-20-F-0597	U.S. Navy	5,869,165.00	DMS OMNIBUS 2020
FA2486-20+A22:D95-C-0001	U.S. Air Force	3,245,327.66	AFSEO ENGINEERING SERVICES AND REACHBACK SUPPORT
N00019-19-G-0008 N0001921F0225	U.S. Navy	2,480,875.00	INVENTORY MANAGEMENT
N00019-19-G-0008 N0001920F0507	U.S. Navy	2,017,102.00	HARDWRE INFRASTRUCTURE AND SOFTWARE OBSOLESCENCE
N00019-19-G-0008 N0001920F0788	U.S. Navy	1,999,999.00	ODIN HW PROCUREMENT
N00019-19-G-0008 N0001921F0106	U.S. Navy	1,996,041.00	OCSO SYSTEMS MODERNIZATION WORKING GROUP (SWMG) 4
N00019-19-G-0008 N0001920F0680	U.S. Navy	1,981,105.00	SMWG CY20 LABOR SUPPORT
N00019-19-G-0008 N0001920F0789	U.S. Navy	1,978,240.00	ODIN HW SOU REPLACEMENT
N00019-19-G-0008 N0001920F0132	U.S. Navy	1,970,935.00	ISRAEL 3F+ FIRST FLIGHT
N00019-19-G-0008 N0001920F0661	U.S. Navy	1,951,388.00	ISRAEL SPICE FLIGHT SCIENCES
N00019-19-G-0008 N0001920F0755	U.S. Navy	1,950,000.00	DEPOT MATERIAL WAREHOUSING
N00019-19-G-0008 N0001920F0071	U.S. Navy	1,931,152.00	OSCAR
N00019-19-G-0008 N0001920F0747	U.S. Navy	1,918,206.00	RVVS UPGRADE
N00019-19-G-0008 N0001920F0623	U.S. Navy	1,900,326.64	ELECTRIC SYSTEMS / 28V BATTERY
N00019-19-G-0008 N0001920F0637	U.S. Navy	1,751,470.00	POLAND INTEGRATION SLDO
N00019-19-G-0008 N0001920F0050	U.S. Navy	1,750,987.50	DTV 20.2 CODE BLUE
N00019-19-G-0008 N0001920F0051	U.S. Navy	1,717,534.44	DTV 20.3 - WING ROOT AND RUDDER HINGE 2 BF-3 MODS
N00019-19-G-0008 N0001920F0604	U.S. Navy	1,687,691.00	ISRAEL MDF SUPPORT
N00019-19-G-0008 N0001920F0413	U.S. Navy	1,607,491.00	DTV 19.5 CODE BLUE V DT MODS
N00019-19-G-0008 N0001920F0777	U.S. Navy	1,539,895.00	ALIS VATE
N00019-19-G-0008 N0001920F0352	U.S. Navy	1,495,795.05	ISRAEL ASIP
N00019-19-G-0008 N0001920F0662	U.S. Navy	1,408,528.00	ISRAEL SPICE MISSION SYSTEMS
N00019-19-G-0008 N00019-20-F-0411	U.S. Navy	1,343,864.00	DMS CNI BROADCOM
N00019-19-G-0008 N0001920F0837	U.S. Navy	1,305,417.00	UK SPEAR 3 ADAPTERS
N00019-19-G-0008 N0001920F5004	U.S. Navy	1,259,928.00	30P05 MDPA & MDFR FOR ISRAEL, JAPAN & KOREA
N00019-19-G-0008 N0001920F0416	U.S. Navy	1,204,112.00	CAD/PAD
N00019-19-G-0008 N0001920F0612	U.S. Navy	1,169,010.00	JAPAN WINDOWS 10 UPGRADE SLDO

N00019-19-G-0008 N0001920F0285	U.S. Navy	1,078,776.00	CAMERI MULTI NATIONAL
N00019-19-G-0008 N0001920F0049	U.S. Navy	1,078,497.00	DTV 20.1 CODE BLUE
N00019-19-G-0008 N0001920F0227	U.S. Navy	1,047,629.00	VWC SW UPGRADE
N00019-19-G-0008 N0001920F0791	U.S. Navy	862,862.00	SOFTWARE LOAD DEVELOPMENT AND RETROFITS FOR ROK
N00019-19-G-0008 N0001920F0497	U.S. Navy	833,016.00	ITALY CAVOUR
N00019-19-G-0008 N0001920F0150	U.S. Navy	792,989.00	DENMARK MDFX
N00019-19-G-0008 N0001920F0839	U.S. Navy	772,819.00	UK METEOR ADAPTERS
N00019-19-G-0008 N0001920F0575	U.S. Navy	708,903.00	JAPAN SSAP SLDO
N00019-19-G-0008 N0001920F0695	U.S. Navy	697,619.00	ACURL FAMILIARIZATION TIMS #3
N00019-18-D-0129 N0001920F0562	U.S. Navy	649,884.00	EXTERNAL FUEL TANK TRADE STUDY
N00019-19-G-0008 N0001920F0222	U.S. Navy	617,577.00	JAPAN SHIP SURVEY SLDO
N00019-19-G-0008 N0001920F0542	U.S. Navy	591,664.00	ALIS ENTERPRISE CYBER TESTING
N00019-19-G-0008 N0001920F0520	U.S. Navy	587,209.00	DTV 19.6 BF-18 FLIGHT TEST INSTRUMENTATION
N00019-19-G-0008 N0001920F0838	U.S. Navy	581,837.00	UK SPEAR 3 AME
N00019-19-G-0008 N0001921F0105	U.S. Navy	571,385.00	ISRAEL LOOSE TOOLS
N00019-19-G-0008 N0001920F0094	U.S. Navy	544,070.00	DTV 20.4 BF-19 FLIGHT TEST INSTRUMENTATION
N00019-19-G-0008 N0001920F0615	U.S. Navy	520,533.00	AUSTRALIA VERIFICATION SIMULATOR (VSIM)
N00019-20-C-0051	U.S. Navy	509,348.00	PROPERTY ACCOUNTABILITY CONTRACT
N00019-19-G-0008 N00019-20-F-0414	U.S. Navy	508,500.00	DTV 19.4 FS503 FRAME LIVE LIMIT MODS
N00019-20-D-0109 N00019-21-F-0161	U.S. Navy	427,062.00	BF100 AND BF103 GFE IDIQ
N00019-19-G-0008 N0001920F0767	U.S. Navy	418,165.00	EO/IR
N00019-19-G-0008 N0001920F0790	U.S. Navy	409,571.00	JAPAN 30P04 SW LOAD AND RETROFIT
N00019-19-G-0008 N0001920F0578	U.S. Navy	390,203.00	TINDAL AUS SATAF
N00019-19-G-0008 N0001920F0753	U.S. Navy	389,574.00	TACTICAL COMBAT TRAINING SYSTEM INCREMENT II
N00019-20-D-0007 N0001920F0191	U.S. Navy	324,112.00	AUTONOMIC LOGISTICS INFORMATION SYSTEM (ALIS) TEST
N00019-19-G-0008 N0001921F0086	U.S. Navy	301,953.00	NORWAY JSM MSIL TESTING #2
N00019-19-G-0008 N0001920F0438	U.S. Navy	298,730.00	INLET MONITORING DEBRIS SYSTEM SLDO
N00019-19-G-0008 N0001920F0724	U.S. Navy	214,778.00	NORWAY IRIG CABLE DEVELOPMENT
N00019-19-G-0008 N0001920F0543	U.S. Navy	161,659.00	INTEGRATION LAB ACCESS FOR CYBERSECURITY TEST
N00019-19-G-0008 N0001920F0706	U.S. Navy	128,968.00	DENMARK DSRR
N00019-20-D-0109 N00019-20-F-0152	U.S. Navy	124,717.00	GFE IDIQ - BF:98
N00019-20-D-0109 N00019-21-F-0224	U.S. Navy	124,339.00	AS25 GFE IDIQ
N00019-19-G-0008 N0001920F0060	U.S. Navy	98,287.00	GPU 9A GUN POD
N00019-19-G-0008 N0001920F0725	U.S. Navy	60,365.00	AUS DSRR

N00019-19-G-0008 N0001920F0631	U.S. Navy	40,301.50	NOR MISSION DATA FILES ENCRYPTION

2019

Federal Grant / Contract Number	Federal Agency / Prime Contract Awarding Agency	Dollar Value	Subject of Contract / Contract Title
N00019-20-C-0009	U.S. Navy	2,702,107,148.00	LOW RATE INITIAL PRODUCTION LOT 15
N00019-19-C-1022	U.S. Navy	1,158,087,730.06	FY19 ANNUALIZED
N00019-19-D-0015 N0001919F2698	Defense Contract Management Agency	530,212,325.00	FY19 SPARES/ LOT 13 AME/PFE MATERIAL REQUIREMENTS
N00019-19-C-0074	U.S. Navy	419,596,684.00	SPECIAL TOOLING AND TEST EQUIPMENT (STATE)
N00019-19-D-0015 N0001919F4207	Defense Contract Management Agency	374,069,824.03	FY19 SPARES - ASP/DSP REQUIREMENTS
N00019-14-G-0020 N0001919F2512	U.S. Navy	329,523,330.00	CY19 ANNUAL MODIFICATIONS AND UPGRADES
N00019-19-G-0008 N0001920F0301	U.S. Navy	261,332,150.00	FULL SCALE DURABILITY TEST
N00019-19-D-0015 N0001919F4216	Defense Contract Management Agency	233,190,595.00	FY19 SPARES - BSP/GSP REQUIREMENTS
N00019-19-D-0015 N00019-19-F-4233	Defense Contract Management Agency	176,543,906.00	FY19 HMD LOT 12-13
N00019-14-G-0020 0104	U.S. Navy	70,170,465.00	USRL CURC
N00019-20-C-0026	U.S. Navy	26,952,334.66	ACURL CRT PHASE II CLIN 0007
N00019-19-G-0008 N0001920F0410	U.S. Navy	13,378,981.00	DEV SEC OPS INFRASTRUCTURE SLDO
N00019-18-D-0129 N00019-19-F-2539	U.S. Navy	4,748,014.00	ALIS NEXT RE-ARCHITECUTRE SUPPORT
N00019-19-G-0008 N0001919F2879	U.S. Navy	3,761,192.00	LRIP 11 OCONUS FERRY SUPPORT
N00019-18-D-0129 N0001919F2976	U.S. Navy	3,493,914.93	ALIS 3.6 DECOMPOSITION REQUIREMENTS
FA2486-19-C-0002	U.S. Air Force	3,926,688.01	AFSEO TOOLSETS 3&4
N00019-18-D-0129 N0001919F2737	U.S. Navy	2,806,912.62	ECASE -- GDR INCREMENT 1
N00019-14-G-0020 N0001919F2599	U.S. Navy	2,293,493.00	ACURL IDA HARDWARE
N00019-19-G-0008 N0001919F4092	U.S. Navy	2,262,718.87	SMWG SUPPORT
N00019-19-G-0008 N0001919F2894	U.S. Navy	1,982,574.00	ISRAEL SPICE ARCHITECTURE STUDY
N00019-14-G-0020 N0001919F2649	U.S. Navy	1,955,681.00	F-35 SOFTWARE SITE SURVEYS
N00019-14-G-0020 N0001919F2620	U.S. Navy	1,954,216.79	QRIP III INTEGRATION
N00019-19-G-0008 N0001920F0508	U.S. Navy	1,953,444.00	DATA TRANSFORMATION AND ARCHETICTURE WORK STREAMS
N00019-19-G-0008 N0001919F2885	U.S. Navy	1,940,954.00	REPROGRAMMING VERIFICATION & VALIDATION SYSTEM
N00019-19-G-0008 N0001919F4228	U.S. Navy	1,883,931.00	FUNCTION 5 INCREMENT 1 INTEGRATION
N00019-19-G-0008 N0001919F2916	U.S. Navy	1,877,645.39	PILOT TRAINING DEVICE ENTITY PROCESS
N00019-14-G-0020 N0001919F2664	U.S. Navy	1,861,566.00	BELGIUM SLDO 1
N00019-14-G-0020 N0001919F2685	U.S. Navy	1,836,469.00	PILOT TRAINIG DEVICE 30P03
N00019-14-G-0020 N0001919F2653	U.S. Navy	1,807,904.00	JRE AAT ENHANCEMENT

N00019-19-G-0008 N0001919F4109	U.S. Navy	1,770,947.00	KOREA SECURITY SURGE SLDO
N00019-19-G-0008 N0001920F0335	U.S. Navy	1,761,693.99	ALIS EEE
N00019-19-G-0008 N0001920F0318	U.S. Navy	1,681,238.20	BELGIUM SLDO 2
N00019-14-G-0020 N0001919F2601	U.S. Navy	1,681,100.00	ACURL IDA SOFTWARE
N00019-19-G-0008 N0001920F0332	U.S. Navy	1,649,610.99	JAPAN SOU MOVE
N00019-14-G-0020 N0001919F2640	U.S. Navy	1,632,033.00	USRL CONTINUOUS MONITORING
N00019-19-G-0008 N00019-19-F-4052	U.S. Navy	1,549,736.00	DT VIABILITY19.3 CODE BLUE SLDO
N00019-19-G-0008 N0001920F0336	U.S. Navy	1,529,305.00	OT SOFTWARE RELEASE
N00019-19-G-0008 N0001919F4256	U.S. Navy	1,500,000.00	F35 PHYSICAL INVENTORY
N00019-19-G-0008 N0001920F0388	U.S. Navy	1,330,000.00	NIRL AAT & ST
N00019-14-G-0020 N0001919F2689	U.S. Navy	1,268,480.20	NLD ASMT
N00019-19-G-0008 N00019-19-F-2904	U.S. Navy	1,160,335.00	USN SSAP & SATAF
N00019-19-G-0008 N0001920F0304	U.S. Navy	1,073,792.00	CHINA LAKE VAL UPDATES
N00019-19-G-0008 N0001919F2962	U.S. Navy	1,053,295.00	UK PEST
N00019-19-G-0008 N0001919F4107	U.S. Navy	1,048,004.00	BOL IR INTEGRATION AND TESTING
N00019-19-G-0008 N0001919F4102	U.S. Navy	1,004,109.00	UK OT ON HMS QUEEN ELIZABETH
N00019-19-G-0008 N0001919F2891	U.S. Navy	970,208.00	SINGAPORE CORE SUPPORT SLDO
N00019-19-G-0008 N00019-19-F-2981	U.S. Navy	962,861.00	DT VIABILITY GUN FIRE BATTERY ISOLATOR SLDO 19.2
N00019-19-G-0008 N0001919F2934	U.S. Navy	786,614.80	TECHNICAL DATA PACKAGE WORKING GROUP
N00019-18-D-0129 N0001919F2651	U.S. Navy	746,713.01	ECASE -- SMWG STUDIES
N00019-14-G-0020 N0001919F0028	U.S. Navy	657,004.00	LEMOORE PEST
N00019-19-G-0008 N0001919F4171	U.S. Navy	636,126.00	SINGAPORE UNIQUE EQUIPMENT STUDY CONTINUATION
N00019-14-G-0020 N0001919F2607	U.S. Navy	608,766.00	AARI II GROUP A WIRING
N00019-18-D-0129 N0001919F2750	U.S. Navy	604,264.00	TR2 CONFIGURATION SUPPORT
N00019-19-G-0008 N00019-20-F-0019	U.S. Navy	588,645.00	ISRAEL SATAF BASE 8
N00019-19-G-0008 N0001919F2928	U.S. Navy	561,421.00	UK CRYSTAL IRIS
N00019-19-G-0008 N0001919F2829	U.S. Navy	532,346.00	IFMV MAINTENANCE AND SUPPORT
N00019-19-G-0008 N0001919F4009	U.S. Navy	476,356.00	NORWAY JSM MSIL TESTING
N00019-19-G-0008 N0001920F0028	U.S. Navy	468,207.00	VWC 2019/2020 NL EVENTS
N00019-19-G-0008 N0001919F4046	U.S. Navy	454,433.82	EOTS LBEST - DMS PARTS BUY
N00019-14-G-0020 N0001919F2809	U.S. Navy	449,287.00	NOR NETWORK DESIGN
N00019-19-G-0008 N0001919F4020	U.S. Navy	422,546.00	ITALY ENCRYPTION
N00019-19-G-0008 N0001919F4021	U.S. Navy	419,344.00	ACURL FLINDERS INVESTIGATOR
N00019-14-G-0020 N0001919F2623	U.S. Navy	416,230.00	DTV URGENT MODS 1Q2019

N00019-19-G-0008 N0001919F4012	U.S. Navy	397,396.00	KOREA ALIS TRANSFER
N00019-18-D-0129 N0001919F2933	U.S. Navy	386,729.00	ECASE TR3 EMULATOR STUDY
N00019-19-G-0008 N0001919F4114	U.S. Navy	351,898.00	USAF PILOT GEAR
N00019-19-G-0008 N0001920F0354	U.S. Navy	317,485.00	ITA PMTS DEC 2019
N00019-14-G-0020 N0001918F0325	U.S. Navy	310,879.00	SSK
N00019-19-G-0008 N0001920F0029	U.S. Navy	293,000.00	RAAF TINDAL SUPPORT
N00019-14-G-0020 N0001919F2557	U.S. Navy	285,140.00	MARK 7 MOD 4
N00019-19-G-0008 N0001919F2909	U.S. Navy	284,738.00	DCA COUPON
N00019-19-G-0008 N0001919F4005	U.S. Navy	249,940.70	IFF SLDO
N00019-19-G-0008 N0001919F2961	U.S. Navy	249,094.00	TIMS FOR CPE CONOPS
N00019-19-G-0008 N0001920F0021	U.S. Navy	222,396.00	ISRAEL PMTS
N00019-19-G-0008 N0001919F2926	U.S. Navy	210,115.00	DNK PMTS AUG 2019
N00019-19-G-0008 N0001920F0307	U.S. Navy	197,432.00	NLD PMTS 2019
N00019-19-G-0008 N0001919F4147	U.S. Navy	186,567.00	SIGNATURE INTEGRATION
N00019-19-G-0008 N0001919F4043	U.S. Navy	171,679.00	AUSTRALIA PMR SUPPORT 2019-2020
N00019-19-G-0008 N0001920F0323	U.S. Navy	138,779.00	ISRAEL OBIGGS
N00019-14-G-0020 N0001919F2671	U.S. Navy	124,423.00	UK FRR SUPPORT 2019
N00019-19-G-0008 N0001920F0297	U.S. Navy	122,856.10	NETHERLANDS STRAY LASER
N00019-19-G-0008 N0001920F0317	U.S. Navy	119,600.10	ITALY G SUITS
N00019-19-G-0008 N0001919F2884	U.S. Navy	117,388.46	MSIL WEAPONS TESTING
N00019-19-G-0008 N0001920F0333	U.S. Navy	98,718.00	JAPAN XWAN
N00019-14-G-0020 N0001919F2554	U.S. Navy	81,704.00	TECHNICAL SUPPORT FOR SLRP TOOL
N00019-19-G-0008 N0001919F2860	U.S. Navy	81,075.80	MSIL NAVIGATION TESTING
N00019-19-G-0008 N0001919F2939	U.S. Navy	61,474.00	AUS DELTA SRR
N00019-14-G-0020 N00019-19-F-2772	U.S. Navy	57,761.00	NLD SOU-C MOVE
N00019-19-G-0008 N0001919F4117	U.S. Navy	49,019.72	NORWAY MDF ENCRYPTION
N00019-19-G-0008 N0001920F0367	U.S. Navy	24,934.00	HELMET MOUNTED DISPLAY OLED SHOWCASE
N00019-19-G-0008 N0001919F2865	U.S. Navy	24,859.00	NORWAY MDF ENCRYPTION

2018 (5/1/2018 - 12/31/2018)

Federal Grant / Contract Number	Federal Agency / Prime Contract Awarding Agency	Dollar Value	Subject of Contract / Contract Title
N00019-19-C-0010	U.S. Navy	2,292,885,305.02	C2D2 F-35 FOM PHASE 2.3
N00019-18-C-1048	U.S. Navy	1,928,059,495.99	LOW RATE INITIAL PRODUCTION 11 NON-ANNUALIZED

N00019-14-G-0020 N0001919F2474	U.S. Navy	1,023,344,844.71	TR3 PHASE 3
N00019-19-C-0004	U.S. Navy	388,979,727.82	DEVELOPMENT FOUNDATION CONTRACT (DFC)
N00019-14-G-0020 N0001918F0472	U.S. Navy	352,280,611.00	LRIP 12 AME/PFE
N00019-14-G-0020 N0001918F2048	U.S. Navy	130,898,840.00	LRIP 11 GEN 3 HEAVY HMDS
N00019-14-G-0020 N0001918F2494	U.S. Navy	71,596,843.23	XILINX/INTEL #1 PARTS BUY
N00019-14-G-0020 0097	U.S. Navy	70,444,538.62	DT AIRCRAFT VIABILITY, PHASE I
N00019-14-G-0020 N0001918F2038	U.S. Navy	30,483,442.00	ALIS SOVEREIGN DATA MANAGEMENT
N00019-18-D-0129 N0001918F1706	U.S. Navy	4,919,272.83	VWC SIMULATOR ADDITIONAL AND UPGRADE
N00019-19-C-0005	U.S. Navy	1,835,241.00	ALIS AGILE SOFTWARE DEVELOPMENT MAD HATTER PROJECT
N00019-14-G-0020 N0001918F2487	U.S. Navy	1,702,529.00	ACURL ZIPPER SLDO
N00019-14-G-0020 N0001919F2468	U.S. Navy	1,700,014.00	ISRAEL LRIP 11 AIRWORTHINESS
N00019-14-G-0020 N0001918F2488	U.S. Navy	1,385,761.00	ACURL TOG SLDO
N00019-14-G-0020 N0001919F2473	U.S. Navy	1,367,328.00	FTI RISK REDUCTION
N00019-14-G-0020 N0001918F6025	U.S. Navy	949,051.00	USRL 3F DTIP CONSOLES INSTALL AND ASSEMBLY
N00019-14-G-0020 N0001918F2624	U.S. Navy	754,930.00	VWC SOFTWARE UPGRADE
N00019-14-G-0020 N0001918F2336	U.S. Navy	655,650.00	USRL 3F SDL AND TOOLS
N00019-14-G-0020 N0001918F0251	U.S. Navy	647,229.00	SINGAPORE CORE SUPPORT STUDY
N00019-18-D-0129 N0001919F2498	U.S. Navy	646,951.00	ECASE TRADE STUDY TO SUPPORT AARGM-ER
N00019-14-G-0020 N0001918F2072	U.S. Navy	639,487.00	ACURL INCEPTIVE TRINITY
N00019-14-G-0020 N0001919F0013	U.S. Navy	578,756.00	ISDD OT&E
N00019-14-G-0020 N0001919F2471	U.S. Navy	539,025.00	EJECTIONS SEATS PHASE 3
N00019-14-G-0020 N0001918F2373	U.S. Navy	533,986.00	UK ATF EFFORT
N00019-14-G-0020 N0001918F0043	U.S. Navy	492,374.99	AARI ON AN-01 INSTALL
N00019-14-G-0020 N0001919F2500	U.S. Navy	454,591.00	ISRAEL IPERC
N00019-14-G-0020 N0001918F2340	U.S. Navy	354,250.00	JADE EEE SUPPORT
N00019-14-G-0020 N0001918F2674	U.S. Navy	345,350.00	AARI THREAT RANGE
N00019-14-G-0020 N0001919F2472	U.S. Navy	317,810.00	EJECTION SEATS PHASE 2
N00019-14-G-0020 N0001918F0270	U.S. Navy	311,946.00	PMA FOR USMC
N00019-14-G-0020 N0001918F2550	U.S. Navy	292,336.64	AARI ON AN-01
N00019-14-G-0020 N0001918F2579	U.S. Navy	291,530.00	ISRAEL LAB HARDWARE DELIVERY ORDER
N00019-14-G-0020 N0001918F0292	U.S. Navy	266,310.00	ORLAND OMS WORKSTATIONS
N00019-14-G-0020 N0001918F0363	U.S. Navy	259,620.00	JOTT VSIM EVENT SEPT 2018
N00019-14-G-0020 N0001918F0052	U.S. Navy	241,003.00	RCS TESTING EVENTS
N00019-14-G-0020 N0001918F2677	U.S. Navy	234,173.00	ACURL EMT EMSIL

N00019-14-G-0020 N0001919F2516	U.S. Navy	223,897.00	19F2516NOR PEST
N00019-14-G-0020 N0001919F2418	U.S. Navy	216,117.04	VWC 2018 NIMBLE LIGHTNING
N00019-14-G-0020 N0001919F2508	U.S. Navy	193,080.00	ITALY PMTS DECEMBER 2018
N00019-14-G-0020 N0001918F0237	U.S. Navy	187,409.00	P5 MSIL TESTING
N00019-14-G-0020 N0001919F2505	U.S. Navy	174,191.00	UK SOFTWARE DEEP DIVE W/ELBIT
N00019-14-G-0020 N0001918F2432	U.S. Navy	167,877.00	AUSTRALIA HEIKICK
N00019-14-G-0020 N0001918F0547	U.S. Navy	167,873.00	JOTT BLACK AND GREY
N00019-14-G-0020 N0001918F0049	U.S. Navy	159,954.00	DNK PMTS SEPT 2018
N00019-14-G-0020 N0001918F2384	U.S. Navy	152,818.00	JOTT CYBER VSIF
N00019-14-G-0020 N0001919F2517	U.S. Navy	147,645.00	VSIM 18-3 TESTING
N00019-14-G-0020 N0001918F0339	U.S. Navy	140,200.00	NLD PMTS EVENT SEPT 2018
N00019-14-G-0020 N0001918F0356	U.S. Navy	138,361.00	AUSTRALIA FERRY TO WILLIAMTOWN
N00019-14-G-0020 N0001918F0349	U.S. Navy	138,240.00	ITALIAN SOU DEPLOYMENT KIT
N00019-14-G-0020 N0001918F0316	U.S. Navy	129,085.00	TRAVEL COSTS FOR IOT&E
N00019-14-G-0020 N0001918F2593	U.S. Navy	99,175.00	NETHERLAND ACADEMIC SMES PART II
N00019-14-G-0020 N0001918F2031	U.S. Navy	66,444.00	33RD GRITS EVENT 3F SIM EXPOSURE
N00019-14-G-0020 N0001918F0063	U.S. Navy	65,511.00	33D FW 3F GRITS EVENTS
N00019-14-G-0020 N0001918F2642	U.S. Navy	64,351.00	50/50CDRL
N00019-14-G-0020 N0001918F0054	U.S. Navy	61,128.00	MTT AMENDOLA DEPLOYMENT
N00019-14-G-0020 N0001919F2409	U.S. Navy	50,154.00	AUS ACADEMIC EVENT
N00019-14-G-0020 N0001918F2497	U.S. Navy	42,085.00	ITALY MDF ENCRYPTION EVENT
N00019-14-G-0020 N0001918F0282	U.S. Navy	41,436.00	422 TES TO KEY WEST
N00019-14-G-0020 N0001918F0042	U.S. Navy	38,837.00	ITAF FERRY
N00019-14-G-0020 N0001918F0620	U.S. Navy	31,227.00	13TH TO DECIMOMANNU
N00019-14-G-0020 N0001919F2414	U.S. Navy	30,812.88	VWC F-16 ROOM RELOCATION
N00019-14-G-0020 N0001918F0234	U.S. Navy	19,746.00	422 TES TO EGLIN
N00019-14-G-0020 N0001918F0279	U.S. Navy	19,033.00	RIVALTO ITALY DEPLOYMENT
N00019-14-G-0020 N0001918F2403	U.S. Navy	14,664.00	SUPPORT FOR 338 MXG TO CENTCOM
N00019-14-G-0020 N0001918F0351	U.S. Navy	10,871.00	SUPPORT FOR 61 FS DETATCHMENT TO PORTLAND
N00019-14-G-0020 N0001918F2065	U.S. Navy	4,589.00	SUPPORT TO BANAK
N00019-14-G-0020 N0001918F1727	U.S. Navy	3,949.92	SUPPORT FOR NORWAY TO BANAK

LM Aero JSF Foreign Contracts

2021 (1/1/21 - 4/15/21)

Federal Grant / Contract Number	Federal Agency / Prime Contract Awarding Agency	Dollar Value	Subject of Contract / Contract Title
CASG/ASD/CON/12985/1	AUSTRALIAN GOV,DEPT OF DEFENCE,AU	66,569,269.01	LM AUS TRAINING SUPPORT SERVICES

2020

Federal Grant / Contract Number	Federal Agency / Prime Contract Awarding Agency	Dollar Value	Subject of Contract / Contract Title
LPT/50164	MINISTRY OF DEFENCE - UNITED KINGDO	2,247,269.00	SF ENABLING WORKS
BELGIUM ESI PROGRAM BELGIUM ESI 01	GOVERNMENT OF BELGIUM	3,575,000.00	BELGIUM ESI 012 IMPLEMENTATION AGRMT - FERONYL ETC
BELGIUM ESI PROGRAM BELGIUM ESI 01	GOVERNMENT OF BELGIUM	100,000.00	BELGIUM ESI 018 IMPLEMENTATION AGRMT - SOLVAY UCS

2019

Federal Grant / Contract Number	Federal Agency / Prime Contract Awarding Agency	Dollar Value	Subject of Contract / Contract Title
CASG/JSF/CON10869/2	AUSTRALIAN GOV,DEPT OF DEFENCE,AU	92,601,643.96	LM AUS IMAS STAFFING
PO 4440969646	MIN OF DEFENSE, GOVT OF ISRAEL	50,750,000.00	ISRAEL TRAINING CENTER PO - OCONUS
CASG/JSF/CONTRACT048	AUSTRALIAN GOV,DEPT OF DEFENCE,AU	43,949,097.47	LM AUS DDMS
PO 4441017193	MIN OF DEFENSE, GOVT OF ISRAEL	7,500,000.00	ISRAEL TRAINING CENTER PO -- CONUS
PO 4440998899	MIN OF DEFENSE, GOVT OF ISRAEL	417,000.00	ISRAEL ICS
LPT/50208	MINISTRY OF DEFENCE - UNITED KINGDO	360,307.67	UTILITY DIVERSION WORKS UK STRATEGIC FACILITY

2018 (5/1/2018 - 12/31/2018)

Federal Grant / Contract Number	Federal Agency / Prime Contract Awarding Agency	Dollar Value	Subject of Contract / Contract Title
PO 4440908383	GOVERNMENT OF ISRAEL	1,677,792.51	MITIGATION OCONUS PO
PO 4440916575	MIN OF DEFENSE, GOVT OF ISRAEL	180,000.00	MITIGATION CONUS PO

STATEMENT OF
MATTHEW F. BROMBERG
PRESIDENT, PRATT & WHITNEY MILITARY ENGINES

BEFORE THE
READINESS AND TACTICAL AIR & LAND FORCES SUBCOMMITTEES
OF THE
HOUSE ARMED SERVICES COMMITTEE
ON
F-35 PROGRAM UPDATE: ACCOMPLISHMENTS, ISSUES, AND RISKS

APRIL 22, 2021

NOT FOR PUBLICATION UNTIL RELEASED
BY THE HOUSE ARMED SERVICES
SUBCOMMITTEES ON
READINESS AND TACTICAL AIR & LAND FORCES

Chairman Garamendi, Chairman Norcross, Ranking Member Lamborn, Ranking Member Hartzler, and distinguished members of the House Armed Services Committee, I appreciate the opportunity to testify on behalf of the 36,000 men and women of Pratt & Whitney (P&W) to provide an update on the production, sustainment, and modernization of the F135 engine. I would also like to thank you for your continued support of the F135 program, which contributes to more than 37,000 high-tech jobs across 35 states and provides our service men and women with a critical technological advantage over our adversaries.

The F135, the world's most advanced fighter engine, powers all three variants of the F-35 Lightning II fighter. The engine has achieved numerous engineering feats including increased thrust and thermal management capacity, adaptive controls, advanced materials, and design-for-sustainment modular architecture. Its 84 percent tri-variant commonality allows for significant economies of scale across the program. Since my testimony in November of 2019, P&W and the F135 have had many accomplishments. Notably, despite the COVID-19 pandemic, P&W successfully delivered 159 engines last year, with the global engine fleet now supporting over 625 F-35s in operation with three U.S. Services and nine international countries. Additionally, in March, P&W fully qualified 75 percent of the F135 parts previously sourced from Turkey. From a sustainment perspective, the global fleet continued to maintain an average mission capability rate of approximately 95 percent. Finally, P&W completed a six-month F135 modernization study and operational assessment – on time and on cost – to develop multiple potential growth configurations for propulsion support of Block 4 aircraft.

At the same time, there have been several challenges. While we are producing engines at an aggregate rate that meets annual production requirements, we are behind contract dates due to quality issues and COVID-19 disruptions. With respect to affordability, P&W has successfully

reduced costs to date; however, we experienced significant cost headwinds in 2020 due to limitations in resourcing parts from Turkey and the adverse impacts of COVID-19 on the commercial market. Finally, while we maintained the average mission capability rate at or above contract requirements, engine availability degraded due to the delayed stand up of depot capacity. For all these challenges, we identified improvement plans and are committed to successful execution in 2021 and beyond.

As the only 5th Generation engine in production, the F135 provides unrivaled performance for the warfighter. With a strong production foundation, P&W is resolute in pursuing production improvements in cost and quality. With a strong reliability foundation, we will address current availability challenges with urgency. Finally, leveraging the robust core of the F135, P&W will provide a series of low-risk, rapid technology upgrades to ensure the F135 remains the most capable engine for the warfighter, and the most cost-effective program for the taxpayer.

Availability: Engine Production

Delivering the F135 to the warfighter on time, 100 percent of the time, and with perfect quality remain critical goals. Over the past five years, P&W and our suppliers have invested over $500 million in capital, process improvements, and cost reduction initiatives to enable both the required increase in production rate and also the reduction in unit cost. In 2020, we launched a $60 million program to improve production quality. These investments will enable a stable, cost effective, and high quality production system for the program of record.

Leveraging these investments, we met or exceeded our annual production targets in 2019 and 2020. However, monthly deliveries were inconsistent. In 2020, P&W delivered 100 percent of its full-year engine quota. Eighty-three percent of the engines were late to the contract date,

but on average, only by 15 days. The principal drivers of these delays were quality findings and COVID-19 disruptions. Despite these delays, P&W continues to have sufficient capacity to support the air vehicle final assembly and sustainment needs, and Lockheed Martin has several months' worth of engines at their Fort Worth, Texas facility awaiting incorporation into aircraft.

Moreover, P&W was able to sustain the health and productivity of P&W's manufacturing and supply chain through prudent use of COVID relief progress payments and an aggressive deployment of P&W's supply chain professionals to help identify and address emerging issues. In fact, P&W was able to accelerate over $300 million of spend into the supply base through a variety of such initiatives. These efforts were critical to enabling overall delivery at the annual target level during the pandemic.

P&W's core values are safety and quality, which serve as the foundation of the design, manufacturing, delivery, and service of all *Dependable Engines*. Our quality management system (QMS) is designed with tiers of protective measures beginning with the engine design process and following the components through manufacturing, inspection, assembly, and test processes. The F135 quality findings rate has remained flat over the past three years; however, the first quarter of 2021 witnessed a slight uptick. Although F135 quality findings drove production delays, they did not impact engine safety or reliability because they are corrected prior to engine delivery. P&W instituted continuous improvement efforts that have reduced the severity of escapes by more than 60 percent since 2016. And, we have committed to a further 40 percent reduction in quality findings through a Quality Improvement Plan (QIP) launched in 2020. This $60 million self-funded, five-year plan will update F135 manufacturing processes with Industry 4.0 machines, measures, and methods.

P&W's goals are simple: 100 percent on-time delivery to contract, with perfect quality. We have capacity in place to support current and anticipated production needs. We have a safe and reliable engine, with a QIP that will drive stability in our production system and engine deliveries. We are not only committed to these goals, but we are also funding their implementation.

Availability: Sustainment

While the F135 currently meets mission capability objectives, engine availability declined in 2020 due to power module shortages. There are multiple causes of the power module shortage, but the primary driver is the delayed stand up of depot capacity. In early 2019, P&W began implementing the necessary corrective actions in partnership with the Joint Program Office (JPO) and the Oklahoma City Air Logistics Complex (OC-ALC) to maintain near-term mission capability targets. However, more work is needed to ensure that we maintain operational readiness as the fleet grows.

Engine availability for the F135 program is contracted and measured by a Non-Mission Capable (NMC) rate. Three critical factors most influence NMC: engine reliability; spare engine ratios; and sustainment network production. P&W is funded to design and support a sustainment network that maintains an NMC rate at no more than six percent. In 2020, NMC averaged five percent for the year, but degraded to seven percent by January of 2021. Over the past three years, the program averaged approximately five percent NMC.

The F135 is reliable, and the engine removal forecast is accurate. Reliability is measured in terms of Mean Flight Hours Between Removal (MFHBR). The current F135 production engine MFHBR is more than two times the program objective. By using these reliability measures and fleet utilization rates, P&W forecasts module removals. Between 2018 and 2020,

P&W predicted 145 power module removals; actual removals were 143. One of the major power module removal drivers over the past three years has been High Pressure Turbine (HPT) blade coating degradation. Although this is not a flight safety issue, P&W approached the problem with urgency, and developed and released a new coating in the spring of 2020. While more testing is required, P&W is confident this will reduce, if not eliminate, the issue.

Forecasted removals are further broken down into workscope estimates. A workscope is the activity required to return a module to a serviceable condition, and dictates the necessary tools, materials, and maintenance hours for repair. There are different levels of workscope based on the type of maintenance at issue. Between 2018-2019, P&W forecasted the correct quantity of power module heavy workscopes; however, the higher-level workscopes requiring heavier effort arrived sooner than anticipated. This occurrence of heavier workscopes earlier than anticipated, combined with an immature sustainment network, created a bottleneck effect that resulted in 47 percent less refurbished power modules, degrading mission capability rates.

In 2020, power module production enablers saw improvement. P&W has made progress in improving the workforce team, tools, and technical data required to maintain modules. We reduced the average turnaround time of engineering dispositions by 58 percent, increased Joint Technical Data (JTD) production by 92 percent, and delivered additional Support Equipment (SE) for module production. P&W and the F135 Heavy Maintenance Center (HMC) at OC-ALC have also focused on maintainer proficiency through a joint training program. The enterprise is on track to more than double depot power module production in 2021, and to nearly double again by 2023.

As the enterprise addresses power module availability recovery, we should also assess engine availability and mission capability. First, while the F135 exceeds reliability targets,

continued investment in the Component Improvement Program is critical. Second, the global F135 fleet is spared at less than half of other P&W engine programs. More spare engines and modules would ensure higher availability as the program matures. Third, sustainment investment has been lower than required, and we need to urgently fund additional depot activations and sufficient spare parts to ensure that depots are ready to support operational readiness. P&W continues to work with the JPO to accelerate additional depot capacity through the activation of international Maintenance, Repair, Overhaul and Upgrade (MRO&U) facilities and the expansion of existing Engine Repair Facilities (ERF), such as P&W's West Palm Beach depot, Naval Air Station Patuxent River (PAX), and Edwards Air Force Base.

Execution of the aforementioned actions will improve engine availability in 2021 and beyond. The challenges of 2020 provide a strong impetus to ensure we fund the necessary sustainment actions to account for fleet growth and uncertainty in the future. By doing so, we will ensure availability for the warfighter.

Affordability: A Cornerstone of the F135

P&W is committed to reducing F135 production and sustainment costs to meet program affordability targets. Since low-rate initial production (LRIP) 1, P&W and the JPO have jointly funded cost reduction through an approximately $200 million War on Cost initiative. These efforts included component redesign, supplier transitions, and manufacturing process improvements. The combined JPO and P&W War on Cost efforts resulted in more than a 50 percent reduction in engine costs and contributed to approximately $8 billion in lifecycle cost savings.

While P&W remains committed to further cost reductions, we will face considerable headwinds that could impact the next Lot buy. First, as the fleet grows and becomes fully

operational, P&W will need to balance cost reduction opportunities with investments in production quality and configuration reliability. Second, we will be challenged by near and intermediate term impacts of the commercial market downturn due to COVID-19 and the resultant disruption of the aerospace supply chain. Third, casting supplier price increases continue to challenge the program. P&W is making strategic investments for the program such as our new turbine airfoil facility in Asheville, North Carolina which will provide a cost-effective alternative to independent casting houses when fully operational. And finally, Turkey's directed removal from the F135 program, and the transition of 188 F135 specific parts, will result in an increase in engine unit recurring flyaway (URF) costs of approximately three percent in the next production contract (Lot 15).

As the program pivots to sustainment, P&W is equally committed to continuous cost reduction. Propulsion makes up about 10 percent of the operating costs of the F-35. Propulsion sustainment costs include the startup cost of establishing the depots, maintenance tools, supplies, and technical data. Propulsion operating costs also include depot maintenance, and materials. Almost 40 percent of today's sustainment spending is related to startup costs. As the fleet grows, these costs will diminish and will be replaced by recurring expenses associated with depot maintenance.

Sustainment cost reduction is driven by investment in engine reliability, repair development, and depot maintenance productivity. The primary source of reliability improvements is the Component Improvement Program (CIP). The F135 CIP is currently under contract to work proposed tasks that are expected to yield $13 billion in lifecycle cost savings for the program. Depot productivity will be advanced though initiatives targeted at improving depot throughput and reducing module repair material costs. For example, P&W has developed and

industrialized more than 200 repairs that enable savings through new spare parts cost avoidance. By the end of 2021, P&W expects to have 400 repairs available. In addition, P&W is partnering with the JPO's Affordability War Room (AWR) to build a pipeline of affordability ideas. To date, there are over 150 new sustainment cost reduction initiatives, with 500 underlying tasks that are ready. The first phase of initiatives, if funded, are anticipated to yield close to $1 billion in sustainment cost avoidance.

Sustainment readiness and cost reduction require funding. However, the return on this investment is improved availability and a reduction in lifecycle costs. We look forward to partnering with the Government to further develop and execute innovative sustainment cost reduction strategies.

Capability: F135 Enhancement Ready

The F135 is the most capable fighter engine in production today. It produces more thrust, features the best low-observable technologies, and supports more thermal capacity than any other fighter engine in operation. Yet, the existing air vehicle is placing new demands on the engine that are resulting in increased maintenance and higher sustainment expenditures. And to P&W's knowledge, the budget for Continuous Capability Development and Delivery (C2D2) does not address propulsion, creating risk that new C2D2 projects could exceed the F135's current capabilities.

Fortunately, the F135 has room to grow. Anticipating the need for propulsion modernization, P&W has self-funded a multi-year conceptual design with the objective of developing a low-risk spiral upgrade path for the F135 that will provide enhanced capabilities. P&W set firm requirements to provide a low-cost Engineering & Manufacturing Development (EMD) program that maintained or reduced URF and improved lifecycle cost,

while ensuring variant commonality and partner acceptance. Leveraging this design, P&W partnered with the JPO to execute a propulsion modernization study. Study results were delivered on March 31, 2021 and are currently under evaluation. This study provides options for agile propulsion upgrades – known as Enhanced Engine Packages (EEP) – that offer increased capabilities to meet immediate warfighter requirements at an affordable cost. EEP can provide double digit improvements in range, thrust, and thermal capacity. A defined propulsion requirement is needed with funding commensurate to support air vehicle capability growth. P&W stands ready to support any propulsion modernization needs.

F135: Aligned with the Warfighter, Maintainer and Taxpayer

The F135 delivers a step change in capability over 4th generation engines. This includes a substantial increase in thermal management capacity enabling the full spectrum of F-35 weapons and sensor capabilities; a precise and responsive integrated engine control system allowing the pilot to focus squarely on the mission; and an unmatched low observable signature enabling the F-35 to conduct operations in modern Anti-Access/Area Denial (A2AD) environments – a core element of the National Defense Strategy. F135 engine reliability exceeds program targets and surpasses prior generation benchmarks. P&W understands the current delivery, quality, and sustainment challenges and will correct them. Finally, the core of the F135 has ample design margin for rapid, low-cost upgrades. P&W remains committed to keeping the F135 available and capable for the warfighter and affordable for the taxpayer.

Matthew F. Bromberg
President, Military Engines, Pratt & Whitney

Matthew Bromberg is president of Pratt & Whitney's Military Engines business where he oversees development, production, and support of the company's military offerings including the 5th generation F119 and F135 engines for the F-22 and F-35 fighters, the F100 for the F- 15/F-16, the F117 for the C-17, the PW4062 for the KC-46A, P&W's Military APU portfolio, and its small engine business. He is also responsible for B-21 bomber engine development and P&W's adaptive engine portfolio for future combat aircraft.

Prior to his current role, Matthew served as president of Pratt & Whitney's Aftermarket business. In this role, Matthew had responsibility for worldwide support of operational Pratt & Whitney and IAE engines. This included engine overhaul centers, part repair centers and material solutions.

Matthew has served in positions of increasing responsibility at the United Technologies Corp. corporate office, Pratt & Whitney, and at Hamilton Sundstrand since joining United Technologies in 2002. Prior to joining Pratt & Whitney, he was vice president of Corporate Strategy and Development for United Technologies Corp., where he led the successful portfolio transformation.

Matthew currently serves on the board of the United Service Organizations of Metropolitan New York and is the executive sponsor of "UTC-4-Vets", an employee resource group for veteran employees of Pratt & Whitney and United Technologies. Before joining United Technologies, Matthew worked as an investment banker at Goldman Sachs and served five years as a nuclear-trained submarine officer in the U.S. Navy.

Matthew holds a Master of Business Administration degree from the Sloan School of Management at Massachusetts Institute of Technology (MIT), a Master of Science degree in Mechanical Engineering from MIT, and a Bachelor of Arts degree in Physics from the University of California, Berkeley.

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DISCLOSURE FORM FOR WITNESSES
COMMITTEE ON ARMED SERVICES
U.S. HOUSE OF REPRESENTATIVES

INSTRUCTION TO WITNESSES: Rule 11, clause 2(g)(5), of the Rules of the House of Representatives for the 117th Congress requires nongovernmental witnesses appearing before House committees to include in their written statements a curriculum vitae and a disclosure of the amount and source of any federal contracts or grants (including subcontracts and subgrants), and contracts or grants (including subcontracts and subgrants), or payments originating with a foreign government, received during the past 36 months either by the witness or by an entity represented by the witness and related to the subject matter of the hearing. Rule 11, clause 2(g)(5) also requires nongovernmental witnesses to disclose whether they are a fiduciary (including, but not limited to, a director, officer, advisor, or resident agent) of any organization or entity that has an interest in the subject matter of the hearing. As a matter of committee policy, the House Committee on Armed Services further requires nongovernmental witnesses to disclose the amount and source of any contracts or grants (including subcontracts and subgrants), or payments originating with any organization or entity, whether public or private, that has a material interest in the subject matter of the hearing, received during the past 36 months either by the witness or by an entity represented by the witness. Please note that a copy of these statements, with appropriate redactions to protect the witness's personal privacy (including home address and phone number), will be made publicly available in electronic form 24 hours before the witness appears to the extent practicable, but not later than one day after the witness's appearance before the committee. Witnesses may list additional grants, contracts, or payments on additional sheets, if necessary. Please complete this form electronically.

Hearing Date: Thursday, April 22, 2021

Hearing Subject:

Subcommittees on Tactical Air and Land Forces and Readiness Joint Hearing: "Update on F-35 Program Accomplishments, Issues, and Risks"

Witness name: Matthew F. Brombreg

Position/Title: President, Military Engines, Pratt & Whitney

Capacity in which appearing: (check one)

○ Individual ● Representative

If appearing in a representative capacity, name of the organization or entity represented:

Pratt & Whitney, a division of Raytheon Technologies Corporation

Federal Contract or Grant Information: If you or the entity you represent before the Committee on Armed Services has contracts (including subcontracts) or grants (including subgrants) with the federal government, received during the past 36 months and related to the subject matter of the hearing, please provide the following information:

2021

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00019-21-C-0006	Department of Defense	$234,732,448	Supplies, services and planning for F135 depot activations
N00019-17-G-0005; N00019-21-F-0325	Department of Defense	$72,676,540	F135 Component Improvement Program, Engineering Project Descriptions
N00019-17-G-8008; N00019-21-F-0056	Department of Defense	$326,635	Implementation of an F135 engineering change
N00019-17-G-8008; N00019-21-F-0220	Department of Defense	$662,532	Implementation of an F135 engineering change

2020

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00019-21-C-0011	Department of Defense	$642,000,002	F135 Performance Based Logistics Sustainment
N00019-17-G-0005; N00019-21-F-0081	Department of Defense	$1,627,997	F135 Component Improvement Program - STOVL Thrust Recovery
N00019-17-G-8008; N00019-20-F-0658	Department of Defense	$7,681,773	Implementation of an F135 engineering change
N00019-17-G-8008; N00019-20-F-0881	Department of Defense	$3,429,769	Implementation of an F135 engineering change
N00019-16-G-0002-N00019-20-F-0212	Department of Defense	$34,495	Labor & Transport for UK Mass Simulator

2019

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00019-G-0005; N00019-20-F-0001	Department of Defense	$58,382,282	F135 Component Improvement Program, Engineering Project Descriptions
N00019-20-C-0005-0004	Department of Defense	$309,357,445	Supplies, services and planning for F135 depot activations
N00019-16-G-0002-N0001919F2849	Department of Defense	$7,061,500	Services to support site activation
N00019-16-G-0002-N0001919F0003	Department of Defense	$75,579	Services to support site activation
N00019-16-G-0002-N0001919F2616	Department of Defense	$3,077,126	F135 depot maintenance activation planning services

2018

Federal grant/ contract	Federal agency	Dollar value	Subject of contract or grant
N00019-18-C-1069	Department of Defense	$266,062,462	Supplies, services and planning for F135 depot activations
N00019-18-C-1021	Department of Defense	$239,691,085	Production of F135 propulsion systems
N00019-16-G-0002-N0001918F0591	Department of Defense	$499,122	Support services for foreign military sales
N00019-16-G-0002-N0001918F2007	Department of Defense	$1,448,288	Support services for foreign military sales
N00019-16-G-0002-N0001919F2518	Department of Defense	$872,568	Implementation services for customs warehouse

Foreign Government Contract, Grant, or Payment Information: If you or the entity you represent before the Committee on Armed Services has contracts or grants (including subcontracts or subgrants), or payments originating from a foreign government, received during the past 36 months and related to the subject matter of the hearing, please provide the following information:

2021

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
None			

2020

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
None			

2019

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
None			

2018

Foreign contract/ payment	Foreign government	Dollar value	Subject of contract, grant, or payment
None			

Fiduciary Relationships: If you are a fiduciary of any organization or entity that has an interest in the subject matter of the hearing, please provide the following information:

Organization or entity	Brief description of the fiduciary relationship
Pratt & Whitney, a division of Raytheon Technologies Corporation	President, Military Engines

Organization or Entity Contract, Grant or Payment Information: If you or the entity you represent before the Committee on Armed Services has contracts or grants (including subcontracts or subgrants) or payments originating from an organization or entity, whether public or private, that has a material interest in the subject matter of the hearing, received during the past 36 months, please provide the following information:

2021

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
Schedule Agreement 5701008583	Sikorsky Aircraft Corporation	$14,403,072.64	Blackhawk Bridge

2020

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
Purchase Order 4400258045	Lockheed Martin Corporation	$131,227	Hardware for development program
Purchase Order 6574042140	Lockheed Martin Corporation	$622,908	F-35 Improved Thermal Margin - Adaptive
Distribution Agreement No. 09/2020	Derco Aerospace, Inc.	$875,000	Parts distribution agreement
Distribution Agreement No. 02/2020	Derco Aerospace, Inc.	-	Parts distribution agreement

2019

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
Purchase Order 4400242511	Lockheed Martin Corporation	$9,083,765	Engineering services for a development program
C-5 Support Agreement	Lockheed Martin Corporation	$771,830	Sustainment engineering support for auxiliary power unit
Purchase Order 6574035518	Lockheed Martin Corporation	$984,879	F-35 Power and Thermal Management Study
General provisions for the CH-53K APU program	Sikorsky Aircraft Corporation	None	General provisions for the CH-53K APU program
Basic Ordering Agreement No. 09/2020	Derco Aerospace, Inc.	-	Parts ordering agreement

2018

Contract/grant/ payment	Entity	Dollar value	Subject of contract, grant, or payment
Purchase Order 4400239641	Lockheed Martin Corporation	$100,000	Engineering services for a development program
EXPEDITE Agreement	Lockheed Martin Corporation	$285,099	Engineering services for a development program
Purchase Order 657405025	Lockheed Martin Corporation	$530,099	Expedite Services
Purchase Order 6574045025	Lockheed Martin Corporation	$160,659	Services
Purchase Order MEB-180523	LM Corporation Missiles & Fire Control	$350,623	NRE Jet Engine Exhaust Sys SOW

Annex to
DISCLOSURE FORM FOR WITNESSES
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This Annex provides a disclosure of the unclassified contracts required to be disclosed by Pratt & Whitney as a nongovernmental witness appearing on April 22, 2021, before the House Committed on Armed Services for a hearing on the subject of "Update on F-35 Program Accomplishments, Issues, and Risks".

Federal Contract or Grant Information:

2020 (Continued from Disclosure Form)

Federal Grant / Contract	Federal Agency	Dollar Value	Subject of Contract or Grant
N00019-16-G-0002-N0019-20-F-0403	Department of Defense	$267,694.00	Services to support Site Activation; Singapore Program Management Support
N00019-16-G-0002-N00019-20-F-0488	Department of Defense	$458,995	Services to Support Site Activation ; Technical Data Working Group
N00019-16-G-0002-N00019-20-F-0058	Department of Defense	$1,526,353	F135 Modernization Study
N00019-16-G-0002 – N00019-20-F-0480	Department of Defense	$1,442,059	Increased F135 Aircraft Bleed Air Study
N00019-16-G-0002-N00019-20-F-0368	Department of Defense	$149,862.00	Services to support Site Activation
N00019-20-C-0011	Department of Defense	$193,780,323	Production of F135 propulsion systems
N0019-20-D-0013-N0001920F0105	Department of Defense	$314,018,351 ($8.5M of which is the undefinitized)	F135 spare engines, spare modules, initial spares
N0019-20-D-0013-N001920F0721	Department of Defense	$159,520,700 ($137,769,941 of which is undefinitized)	F135 initial spares

2019 (Continued from Disclosure Form)

Federal Grant / Contract	Federal Agency	Dollar Value	Subject of Contract or Grant
N00019-17-G-8008-N0001919F4082	Department of Defense	$1,390,805	Implementation of an engineering change
N00019-17-G-0005-N0001919F0001	Department of Defense	$71,407,381	F135 component improvement program for 2019
N00019-17-G-0005-N0001919F4018	Department of Defense	$1,173,540	F135 component improvement program services and testing
N00019-17-G-0005-N0001919F2929	Department of Defense	$642,035	F135 component improvement program services
N00019-17-G-0005-N0001919F2900	Department of Defense	$467,521	F135 component improvement program trade study
N00019-17-G-0005-N0001919F2889	Department of Defense	$943,597	F135 component improvement program services
N00019-19-C-0054	Department of Defense	$108,000,000	F135 alternate sourcing initiative

Annex to
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2018 (Continued from Disclosure Form)

Federal Grant / Contract	Federal Agency	Dollar Value	Subject of Contract or Grant
N00019-17-G-8008-N0001918F2649	Department of Defense	$10,529,593	Implementation of an engineering change
N00019-19-C-0007	Department of Defense	$230,144,943	Testing support for the F135 Block 4 Flight Test Program
N00019-17-G-0005-N0001918F2412	Department of Defense	$63,499,364	F135 component improvement program for 2018

STATEMENT OF

LIEUTENANT GENERAL ERIC FICK
PROGRAM EXECUTIVE OFFICER
F-35 LIGHTNING II PROGRAM

BEFORE THE

TACTICAL AIR LAND FORCES AND READINESS SUBCOMMITTEES
OF THE
HOUSE ARMED SERVICES COMMITTEE
ON
F-35 PROGRAM ACCOMPLISHMENTS, ISSUES, AND RISKS

APRIL 22, 2021

NOT FOR PUBLICATION UNTIL RELEASED BY
THE HOUSE ARMED SERVICES COMMITTEE

Introduction

Chairmen Garamendi and Norcross, Ranking Members Lamborn and Hartzler, and distinguished Members of the Subcommittees, thank you for this opportunity to discuss the status and future of the F-35 Lightning II Program.

The F-35 Lightning II is the Department of Defense`s largest acquisition program and is of vital importance to our Nation's security. The F-35 we have today has shown exceptional performance in operations around the globe. Tomorrow's engagements; however, featuring Chinese and Russian warfighting environments, must be supported by novel operational concepts and rapid weapons development and capability delivery timelines. Consequently, we need a capable, available, and affordable F-35 to outpace these key competitors and win the high-end fight. As we move forward with these three mandates as our guiding lights, the F-35 will increasingly serve as the backbone of U.S. and International Partner air combat superiority for decades to come. The F-35 is replacing, and will continue to replace, the legacy tactical fighter fleets of the Air Force, Navy, and Marine Corps with a dominant, multirole, fifth generation aircraft, projecting U.S. power and deterring potential adversaries.

The F-35 program embodies the U.S. National Defense Strategy as it strengthens alliances and attracts new partners. Seven international partners are invested with the United States in the development, production and sustainment of F-35 via senior diplomatic agreement: the United Kingdom, Italy, the Netherlands, Canada, Australia, Denmark and Norway. F-35 partners contribute to program costs and are vital to the F-35 industrial base and global sustainment strategy. In 2021, F-35 partners will support NATO Arctic air policing missions, and will participate in joint and combined exercises around the world with the U.S. Air Force, U.S.

Navy and U.S. Marine Corps. The F-35 also has a long and growing list of Foreign Military Sales customers, including: Israel, Japan, South Korea, Belgium, Poland, and Singapore.

The F-35 program executes across the entire spectrum of acquisition, to include development and design, flight test, production, fielding and base stand-up, sustainment of fielded aircraft, and building a global sustainment enterprise. It is indeed a large, complex, rapidly growing and accelerating program that is moving in the right direction. My overall assessment is that the program is making solid and steady progress on all aspects and we are improving each day. With that said, the program also has known risks and challenges, but I am confident the F-35 enterprise will be able to overcome these issues and deliver on our commitments. Today I will give you a detailed update on current progress, providing a balanced look at where the program stands, pointing out both the accomplishments and the challenges.

Capability

The F-35 is delivering high-end, game-changing capabilities today. Lauded by pilots and operational commanders alike, the F-35 currently performs operations from land and from the sea. More than 625 aircraft have been delivered to date; 11 services in nine countries have declared initial operational capability; and six services from five countries have conducted F-35 operational missions. The F-35 is being fielded into a dynamic, ever-advancing threat environment. In order to continue to provide the capability our warfighters need, the F-35 program continues to focus on software development and Air System modernization and sustainment.

We understand today's threats, deliberately engage with our warfighting customers to understand future threats, and actively assess the additional capabilities required to meet them as part of a rigorous and continuous process. From a modernization perspective, Block 4 is the key set of capabilities that are required to ensure the F-35 stays dominant in the late 2020s and

beyond. We are diligently working and incrementally delivering it today. Simply put, Block 4 capabilities, enabled by the Technical Refresh-3 (TR-3) hardware suite, ensure F-35 relevance in the high-end fight. Full Block 4 capability will increase our ability to prosecute targets in contested environments, increase survivability, advance interoperability, and improve sustainment. The development foundation established as part of our Block 4 efforts will provide the bedrock for the continuous delivery of these future capabilities.

Due to the complexity of the TR-3 development, we have recently experienced cost and schedule challenges on this part of the program, and are implementing aggressive cost control and prioritization efforts to keep the most critical elements of the broader Block 4 program moving forward. These delays are due to the late completion of the final TR-3 developmental hardware configuration, which is delaying TR-3 software and system integration testing. The F-35 Joint Program Office (JPO), Lockheed Martin, and critical suppliers are aligned on our commitment to cost control and are focused on two critical priorities: the delivery of all Lot 15 aircraft in the TR-3 configuration, and the delivery of key elements of the Lot 17 hardware configuration to meet Block 4 capability requirements. Working together, the F-35 JPO and Lockheed Martin have put mitigation measures in place to ensure that delays in reaching some TR-3 milestones will not impact aircraft delivery. Thanks to these efforts – and even with these challenges – TR-3 will still deliver in Lot 15 in 2023 as required. The F-35 JPO is also implementing recent Software Independent Review Team (IRT) recommendations to improve our ability to deliver software-centric capabilities in support of TR-3 and Block 4. These IRT action plans support progress towards improved performance with the goal to break the fly-fix-fly culture and drive deficiency discovery and resolution earlier in the development cycle.

The drive to maintain U.S. advantage is propelling the Department forward, creating a suite of networked capabilities, anchored around F-35 integration. This integration provides

theater Commanders with improved interoperability amongst platforms in all domains, a more robust intelligence picture, and a wider range of options in support of targeting. We are seeing these benefits from F-35s deployed today and the impact of this aircraft will increase exponentially as additional capabilities are released to the fleet.

Affordability

We absolutely understand that all F-35 customers have limits on the resources available to the program. If we, the F-35 Enterprise, do not meet affordability requirements, our customers will be forced to choose between buying less, flying less, or pursuing alternative solutions to meet their fighter force needs.

The F-35 JPO, U.S. Services, and Partners are working together to identify ways to drive down costs. In the last year, we introduced a variety of affordability initiatives, designed to drive cost out of the program and ensure our warfighters have the capability they need. The JPO has established strategic Affordability Targets throughout the program aimed at reducing the total cost of ownership of the F-35. In development, the program's focus is on cost control of TR-3 and other Block 4 capabilities, as well as reducing the cost of the test enterprise and other fixed development costs. In production, the program continues to hone internal affordability objectives for unit costs of the engine and air vehicle for Lots 15-23, and in sustainment, the U.S. Services have provided affordability constraints for Cost per Flight Hour and Cost per Tail per Year to address life cycle cost drivers. From Fiscal Year (FY) 2014 to today, we have reduced the aircraft procurement cost by 26 percent – going from almost $108 million to $80 million for upcoming U.S. Air Force F-35A deliveries.

Despite that strong effort on production costs, we vividly understand that the largest share of program cost is in sustainment; in fact, sustainment costs are projected to constitute 80 percent of the program's lifecycle cost. The F-35 JPO recognizes the imperative to drive down the

sustainment cost of the platform for all of our stakeholders, and we are doing just that. In 2019 using then year dollars, the F-35 fleet average cost per flight hour was $42,400 and the cost per tail per year was $7.9 million. In constant year 2012 dollars, the most recent F-35 JPO actual cost per flight hour data is $38,300 and cost per tail per year is $7.5 million averaged across all F-35 variants. Furthermore, and also in constant year 2012 dollars, the U.S. Air Force's F-35A 2020 actuals show the cost per flight hour was $33,300 and cost per tail per year was $7.0 million. Though we have experienced challenges in reducing sustainment costs for the F-35, we project a decrease to sustainment costs over the life of the program as fleet size grows and the Department of Defense maximizes economies of scale. The remaining 2020 actuals are still in work.

But scale alone will be insufficient. Accordingly, we are aggressively pursuing Reliability and Maintainability initiatives and examining both organic and contract logistics support options to reduce sustainment costs over the life cycle. F-35 lifecycle costs include, but are not limited to: personnel, maintenance, fuel, ordinance, training and simulation systems, reprogramming laboratories, physical infrastructure, and a global supply network that will keep a fleet of more than 3,000 domestic and international aircraft fully-operating, and contributing to the fight for decades to come. We must leave no stone unturned in each and every one of these areas in order to drive improved life cycle affordability into the program.

Availability

Last year, the overall Mission Capability rate for the F-35 Fleet continued its steady rise, increasing to an annual average of 68 percent through November, an improvement of 5.4 percent from calendar year 2019, while flying nearly 94,000 hours, which was over 18,000 more hours than in the year prior.

In October 2020, USAF F-35As completed 18 months of continuous Middle East combat, flying roughly 4,000 combat sorties and 20,000 combat hours, and employing just shy of 400 weapons while maintaining a 74 percent Fully Mission Capable rate.

At this stage in F-35 fleet maturity, our production line is stable, and aircraft rolling off the line are performing well. Many of our earlier lot aircraft require modifications, and we are working through retrofits with fleet customers to optimize the timing of these modifications to minimize operational impacts. Government and industry teams are working to accelerate an affordable long-term solution while maximizing near-term F-35 availability for training and operations. These changes are driving a steady increase in aircraft full-mission capable rates, and we anticipate fleet availability will continue to climb as F-35 maintenance systems and best practices mature.

The F-35 JPO is using four primary availability levers to achieve current and future readiness. First, we need to keep parts on the aircraft longer. Improving reliability and maintainability is therefore our first lever, and this critical work is progressing through our Reliability and Maintainability Improvement Program (RMIP) Projects. RMIP has validated 2.6 percent improvement to Mission Capable rates and we expect to achieve an additional 4.7 percent over the next three years. Second, we need to have parts "on the shelf" and available when required; we refer to this lever as improving our supply posture. We utilize strategic contracting and service level agreements to incentivize on time delivery of spares and to achieve target stock levels. The F-35 JPO appreciates the Congressional support we have received over the last few years in this area. We received a congressional plus up in funding in FY 2018 to procure four additional U.S. Marine Corps STOVL engines and those engines will continue to deliver through November 2021. Additionally, in FY 2019 and FY 2020 the JPO received congressional plus ups to increase the Global Spares Pool. Third, we must establish repair

capacity so that when those parts fail, they can be returned to service. We are actively accelerating depot standup to expand capacity, and are also incentivizing contractors to invest in and scale repair capacity. The final lever is repair velocity. While we accelerate depot standup we are also increasing process control and learning. We are incentivizing contractors to improve depot repair cycle time performance through service level and performance-based logistics agreements.

Corrective Actions in Place

Like many of its predecessor aircraft, the F-35 has experienced developmental challenges along the way; we are prepared to discuss the status of corrective measures so you have a clear picture of how we will meet our commitments to Congress, the men and women who operate this aircraft, and to the taxpayers who entrust us with their security.

As we recently informed the committees, the F135 Power Module repair in our depot enterprise has not been keeping pace with engine removals, resulting in degraded fleet availability. These production shortfalls have been driven by delays in delivering required support equipment and technical data, along with increased work scope of Power Module repairs. These factors impacted the ability of our sole heavy maintenance Power Module repair depot at the Oklahoma City Air Logistics Complex to scale production in order to meet demand and develop the proficiency of the depot workforce to support the required repair throughput. We, along with our industry partner Pratt and Whitney, have taken action to accelerate delivery and refinement of Technical Data and critical Support Equipment. We have worked with the depot to provide additional training to increase proficiency and improved process efficiency in support of standing up a second shift later this year in to reduce repair turnaround time. Further, we are leveraging internal funding in addition to the congressional increase to accelerate expanding our enterprise depot capacity through the addition of additional support equipment at

the Oklahoma City Air Logistics Complex to provide increased throughput. To further increase Power Module repair capacity we are working to accelerate the stand up of engine repair at the Fleet Repair Center South East in Jacksonville, FL. We are also leveraging excess commercial capacity, and are accelerating the standup of organic back shop repair to support a reduction in repair time at all of our CONUS and OCONUS depots. We are also focused on initiatives to reduce forecasted depot demand by leveraging the Component Improvement Program to improve reliability and availability of engine components. The actions we have taken to date have begun to show benefit, as power module production at the Oklahoma City Air Logistics Complex has increased significantly in the last year and the projected readiness impacts, while still above our requirement, have started to stabilize. As a result of the extensive nature of our F135 initial 2,000 hour overhaul inductions beginning in 2022, we anticipate cost growth in the propulsion enterprise through the Fiscal Year Defense Plan. We are continuing to work with Pratt and Whitney on steps to address the projected cost growth to ensure that the F135 Propulsion System remains affordable component of the F-35 Air System.

As you are also well aware, and as we discussed extensively in my last testimony, the F-35 Enterprise has historically struggled with the Autonomic Logistics Information System (ALIS) system. ALIS is a complex system with numerous documented shortfalls and technical challenges. You will recall last year that we announced the start of a new system, known as the Operational Data Integrated Network (ODIN), to replace ALIS. ODIN will incrementally provide a modern, user-friendly integrated information system for the F-35. It will be comprised of multiple elements to include modern hardware, architectures, software development methods, data environments, and platforms.

In 2020, we achieved several accomplishments to improve the warfighter experience while also beginning the migration to ODIN. With direct input from the users, we delivered

multiple ALIS software updates and capabilities that enhanced the user experience, increased system performance, and reduced cyber vulnerabilities. Further, we established multiple initiatives that are laying the foundation to drive down the number of ALIS administrators to sustain the system and reduce sustainment costs. In September 2020, we tested a modern ODIN hardware kit at U.S. Marine Corps Air Station (MCAS) Yuma, AZ running current ALIS software. The new kit is 75 percent smaller, weighs 90 percent less than the current hardware, and is projected to be 30 percent cheaper. In addition to the smaller footprint, we are seeing significant performance improvements in ALIS such as data processing and synchronization times 2-3 times faster than ever seen before as well as faster screen refresh and response times. According to the users, the new hardware is a "Grand Slam!" We have already procured multiple ODIN hardware kits that will begin to roll out to units later this summer.

Although these efforts have demonstrated positive outcomes with legacy ALIS software, the outdated ALIS system architecture, which is over 15 years old, prevents us from taking full advantage of modern technologies, modern software development practices, and improved cybersecurity. ODIN began its initial journey working with the U.S. Services and Partners to establish the Capability Needs Statement and User Agreement in late 2020. These two documents established the foundational requirements for the ALIS to ODIN migration and described how the users will stay engaged during development activities. The JPO and Lockheed Martin established a contract that captured data rights, frequent software deliveries, and proper data marking for modern software development. ODIN software was developed using modern tools, techniques, and standards. Additionally, Lockheed Martin developed software in a Government-provided environment and demonstrated data integration in a Government-managed data environment.

Despite all the positive activities, we underestimated the complexity of deprecating ALIS capabilities while migrating to ODIN and learned several important lessons. Our approach must maintain our existing, legacy business system (while operations continue to grow and scale) while simultaneously transitioning to a modern system – in other words, as we transition from ALIS to ODIN, it will be an evolution, not a switch. There is work underway to develop the overarching enterprise architecture to guide transition activities and maximize the use of commercial off the shelf and government off the shelf capabilities.

As our team laid the foundation for the ODIN strategy and worked to understand the implications of what we learned technically over the course of 2020, the appropriated ODIN Research, Development, Test, and Evaluation funding in FY 2021 was reduced to 42 percent less than requested and required. This reduction will serve as an opportunity to take a "strategic pause", while we use our 2020 accomplishments and lessons learned to inform and update the strategy for the ALIS to ODIN evolution. We will continue to field and leverage the modern ODIN hardware. For example, the processing power of the new hardware will allow us to host multiple squadrons on a single kit which will yield a drastic reduction in hardware procurement costs and administrators. We have initiated the development of an enterprise architecture leveraging commercial and government best practices to document the stakeholders, business processes, data, and technology to build the transformational roadmap to migrate from ALIS to ODIN. We are strengthening our partnership with industry Lockheed Martin since they have deep knowledge of the existing system, and also collaborating with the Navy and Air Force to leverage their ongoing development activities to maximize our alignment with their roadmaps. The JPO is currently updating its ODIN development plan based on the updated strategy, available resources, as well as inputs received from our users. We look forward to continuing to update you on ALIS and ODIN progress and milestones in the coming months.

The Joint Simulation Environment (JSE) is a government-owned, state-of-the-art simulation facility designed to support operational testing of the F-35, and in the future, other U.S. weapons systems. The JSE allows operational testers to assess the F-35's mission effectiveness in battlespace scenarios that cannot be conducted on open-air test ranges, including stressing, high-density threat environments. The F-35 Initial Operational Test and Evaluation requires 64 mission trials to be conducted in the JSE and evaluated before the Director of Operational Test and Evaluation's Beyond Low-Rate Initial Production (BLRIP) report is written. The BLRIP report must be submitted to Congress before the Full Rate Production milestone can proceed. Development at the JSE has been delayed over the last year due to the combined effects of technical challenges and COVID-19. The challenges of the JSE include not only its unparalleled complexity and required fidelity, but also the technical challenges associated with the integration of high fidelity models from multiple external organizations to create a comprehensive, realistic threat environment. This development work is conducted in a classified, enclosed, close-quarters environment. Telework is not possible, and team size has been limited in the classified work spaces. The F-35 JPO and our Service teammates continue to forge forward to mitigate these challenges to ensure F-35 achieves its Full Rate Production milestone.

Progress Continues

The F-35 was designed to evolve at the speed of advancing threats. The capabilities we are delivering today are distinct from those conceptualized at the start of this program over 20 years ago. The F-35 is leveraging new concepts in the technology environment, to include digital twinning, agile software development, cloud-based collaboration, and a process we refer to as continuous capability development and delivery, or "C2D2." Through close work with the operational requirements and test communities, the C2D2 process will continue to mature and

deliver increments of capability over time to ensure our warfighting customers stay ahead of the threat well into the future.

We are at a strategic inflection point, moving from initial development and fielding to modernization, high-rate production, and global fleet sustainment as we partner with Lockheed Martin and Pratt and Whitney to deliver cost effective, war-winning capabilities. We are changing our contractual relationships with these industry partners, as well. Our production contracts today, including Lots 12 through 14, feature supplier incentives and performance incentives that drive cost reduction at the supplier level and improve production line velocity. Our sustainment contracts incentivize mission capability rates and supplier metrics that ensure our warfighters have the system they need when they need it.

We continue to look for ways to improve these business relationships, including potential multiple-year and multi-year contracts for production and performance-based logistics, or PBL, contracts for supply chain. In fact, we are working today with Lockheed Martin to define the parameters of a supply support and demand reduction PBL that meet our warfighters' operational demands, our taxpayers' best-value demands, and our enterprise's demands for greater organic sustainment to maximize use of organic industrial base planned capacity.

Conclusion

The F-35 is the premier multi-mission strike fighter of choice for three U.S. services, seven International Partners, and six Foreign Military Sales customers. The F-35 routinely demonstrates its unmatched capabilities at the hands of our joint and international warfighters, performing combat operations from land and from the sea. As the world's most widely proliferated strike fighter platform, the F-35 combines stealth, sensor fusion, and interoperability with joint and allied forces to dominate today's – and tomorrow's – advanced threats. The F-35 program team continues to execute Block 4 capability development and delivery, is aggressively

approaching full-rate production goals for new aircraft deliveries at reduced cost, and is sustaining the ever-growing global fleet.

As we work to retire remaining engineering and software issues, the whole of the F-35 enterprise is laser-focused on reduction of lifecycle costs. Cost is the common enemy on this program. Every F-35 stakeholder is aggressively engaged in identifying affordability initiatives. Our team is committed to continue working closely with Congress, our warfighting customers, and industry partners, and we take pride in developing, producing, and sustaining the world's most lethal aircraft. We will continue to demand the highest quality from our industry partners and to aggressively drive cost out of the production line. We will follow through on our commitments to improve Full Mission Capable Rates, particularly among our forward deployed squadrons, and drive down operating costs for the global fleet. We serve with the single-minded determination that the U.S. and its allies will have the capabilities they need to win the fight, that our warfighters will return home safely from every engagement, and that our taxpayers get the absolute best capability for their defense dollar.

Lieutenant General Eric T. Fick
Program Executive Officer for the F-35 Lightning II Joint Program

Lt. Gen. Eric T. Fick is the Program Executive Officer for the F-35 Lightning II Joint Program Office in Arlington, Virginia. The F-35 Lightning II Joint Program Office is the Department of Defense's agency responsible for developing, delivering and sustaining the F-35A/B/C, the next-generation strike aircraft weapon system for the Air Force, Navy, Marine Corps, eight international partners and four current foreign military sales customers.

Lt. Gen. Fick entered the Air Force in September of 1990 after graduating from the University of Notre Dame with a Bachelor's degree in Aerospace Engineering. He has served as a Logistics Plans and Programs Officer, F-16 Fighting Falcon Mechanical Systems Engineer, Computational Fluid Dynamics Research Engineer, Joint System Program Office Chief of Test, Air Staff Branch Chief, Deputy Chief of the Air Force Senate Liaison Office and Director of Global Reach Programs, Office of the Assistant Secretary of the Air Force for Acquisition. Lt. Gen. Fick has commanded at the squadron and group level and served twice as an Air Force Program Executive Officer. Additionally, he has logged more than 350 hours in the T-38 Talon, F-15 Eagle, F-16 and other military and civilian experimental aircraft.

Prior to his current assignment, Lt. Gen. Fick was the Deputy Program Executive Officer for the F-35 Lightning II Joint Program.

EDUCATION
1990 Bachelor of Science, Aerospace Engineering, University of Notre Dame, South Bend, Ind.
1995 Master of Science, Aeronautical Engineering, Air Force Institute of Technology, Wright-Patterson Air Force Base, Ohio (Distinguished Graduate)
1996 Squadron Officer School, Maxwell AFB, Ala.
1998 Experimental Flight Test Engineer Course, Air Force Test Pilot School, Edwards AFB, Calif. (Distinguished Graduate)
2003 Master of Military Operational Art & Science, Air Command and Staff College, Maxwell AFB, Ala. (Distinguished Graduate)
2006 Air War College, Maxwell AFB, Ala., by correspondence
2007 Program Management Office Course, PMT-352B, Eglin AFB, Fla.
2009 Master of Science, National Resource Strategy, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C. (Distinguished Graduate; Honor Graduate)
2009 Senior Acquisition Course, Industrial College of the Armed Forces, Fort Lesley J. McNair, Washington, D.C.
2010 Air Force Enterprise Leadership Seminar, University of Virginia, Darden School of Business, Charlottesville
2011 Program Manager's Course, PMT-401, Fort Belvoir, Va.
2012 Executive Program Manager's Course, PMT-402, Fort Belvoir, Va.

ASSIGNMENTS
September 1990 - March 1992, Logistics Plans and Programs Officer, Hill Air Force Base, Utah
March 1992 - March 1994, F-16 Mechanical Systems Engineer, Hill AFB, Utah
March 1994 - December 1995, Student, Air Force Institute of Technology, Wright-Patterson AFB, Ohio
December 1995 - December 1996, Computational Fluid Dynamics Engineer, Wright-Patterson AFB, Ohio
December 1996 - December 1997, Flight Test Program Manager, Wright-Patterson AFB, Ohio
December 1997 - December 1998, Student, U.S. Air Force Test Pilot School, Edwards AFB, Calif.
December 1998 - July 2000, Deputy Chief, Weapons Test Flight, Eglin AFB, Fla.
July 2000 - July 2002, Chief of Test, Counter-Air Joint System Program Office, Eglin AFB, Fla.
August 2002 - June 2003, Student, Air Command and Staff College, Maxwell AFB, Ala.
July 2003 - September 2003, Director, Direct Attack, Air Force Program Executive Office (Weapons),

Assistant Secretary of the Air Force (Acquisition), Headquarters U.S. Air Force, the Pentagon, Arlington, Va.
September 2003 - May 2004, Chief, Air Dominance Branch, Global Power Directorate, Assistant Secretary of the Air Force (Acquisition), Headquarters U.S. Air Force, the Pentagon, Arlington, Va.
May 2004 - July 2005, Deputy Chief, Air Force Senate Liaison Office, Assistant Secretary of the Air Force (Legislative Liaison), Headquarters U.S. Air Force, the Pentagon, Arlington, Va.
August 2005 – June 2006, Operations Officer, 46th Test Squadron, Eglin AFB, Fla.
July 2006 – July 2008, Commander, 46th Test Squadron, Eglin AFB, Fla.
August 2008 – June 2009, Student, Industrial College of the Armed Forces, Fort McNair, Washington, D.C.
July 2009 – August 2011, Commander, Advanced Combat Systems Group, Air Force Rapid Capabilities Office, Headquarters U.S. Air Force, the Pentagon, Arlington, Va.
September 2011 – July 2014, Program Executive Officer for Intelligence, Surveillance, Reconnaissance, and Special Operations Forces, Wright-Patterson AFB, Ohio
July 2014 – April 2016, Program Executive Officer for Fighters and Bombers, Wright-Patterson AFB, Ohio
April 2016 – May 2017, Director, Global Reach Programs, Assistant Secretary (Acquisition), the Pentagon, Arlington, Va.
May 2017 – present, Deputy Program Executive Officer, F-35 Lightning II Joint Program Office, Arlington, Va.

SUMMARY OF JOINT ASSIGNMENTS
1. May 2017 – present, Deputy Program Executive Officer, F-35 Lightning II Joint Program Office, Arlington, Va. as a brigadier and major general

FLIGHT INFORMATION
Rating: none
Flight hours: more than 350
Aircraft flown: T-38, F-15B, F-15E, F-16, F-18, Learjet-24, E-3A, KC-135R, T-39E, C-17A, C- 141C, MiG-15, T-43A, Challenger 604, C-12C, MC-130E, Bell 206, NC-130H, NU-1B, TH-6B, T-6G, Cessna Citation, CM-170, MB-326, L-039C, ASK-21, L-23, Grob-103, Schweizer 2-33

MAJOR AWARDS AND DECORATIONS
Distinguished Service Medal
Defense Superior Service Medal
Legion of Merit
Defense Meritorious Service Medal
Meritorious Service Medal with oak leaf cluster
Aerial Achievement Medal with oak leaf cluster
Joint Service Commendation Medal
Air Force Commendation Medal with oak leaf cluster
Air Force Achievement Medal
Military Outstanding Volunteer Service Medal

EFFECTIVE DATES OF PROMOTION
Second Lieutenant July 23, 1990
First Lieutenant July 23, 1992
Captain July 23, 1994
Major Sept. 1, 2001
Lieutenant Colonel May 1, 2005
Colonel Oct. 1, 2008
Brigadier General Oct. 3, 2014
Major General Aug. 3, 2018
Lieutenant General July 11, 2019

(Current as of August 2019)

F-35 PROGRAM ACCOMPLISHMENTS, ISSUES, AND RISKS

United States Air Force
Presentation to the
Tactical Air Land Forces and Readiness Subcommittees
of the House Armed Services Committee

Brigadier General David Abba
Director of the F-35 Integration Office,
Headquarters United States Air Force

Hearing Date: April 22, 2021

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I Introduction

Chairman Norcross, Ranking Member Hartzler, distinguished members of the Tactical Air and Land Forces Subcommittee; and Chairman Garamendi, Ranking Member Lamborn, and distinguished members of the Readiness Subcommittee; thank you for the opportunity to discuss F-35 accomplishments, issues, and risks today on behalf of the United States Air Force.

The United States Air Force is absolutely committed to the F-35. The F-35 we have today has performed very well in operations our Airmen have conducted in permissive and contested environments around the globe. But we are not paying for the F-35 to perform "very well;" we are paying for outstanding. We are paying for the outstanding capability we need to compete, deter, and win in the contested to highly-contested environments that our peer competitors have already fielded, and are actively improving at a rapid pace, today.

The Air Force will ultimately possess and operate the world's largest F-35 fleet. As such, we will simultaneously be the program's most demanding customer—and its staunchest advocate. The Air Force recognizes and appreciates the tremendous progress the government and industry team has made, with the help of the Congress, to deliver the formidable weapons system we have today. The F-35 is the only western Fifth Generation aircraft currently in mass production; it provides the United States and our closest Allies and partners with potent combat power. Most of this statement, however, will focus on the progress we still need to make in coming years to maximize our future warfighting readiness. Realizing the F-35's full potential will maximize the return on investment for the F-35 international partnership's significant financial and political commitments made since the award of the Systems Development and Demonstration contract on 26 October 2001.

Before digging deeply into the F-35 attributes we need, we must first consider the F-35 in the context of the broader Air Force fighter portfolio. Each fighter in our current fleet executes complementary missions with a degree of necessary overlap. In looking toward the required attributes of our fighter force design, it is clear we need an effective and affordable balance of capabilities that span the spectrum of enduring demands on our force, from the ability to achieve air superiority with persistence in highly-contested environments to defending the homeland. We must have the right mix of capabilities in the right capacity to ensure combat readiness for today and tomorrow, while making steady progress toward reducing the average age of our fighter fleet.

A fighter portfolio comprised of complementary capabilities allows Air Force Component Commanders to force package to meet unique mission demands; fighters rarely, if ever, execute missions alone. For example, if called upon to fight a peer adversary today in a highly-contested environment, the F-22 and F-35 would provide a potent 1-2 punch as part of a joint or coalition team. In the future, our Next Generation Air Dominance platform will be an even-more formidable teammate for the F-35 in that environment. In lesser-contested environments, partnering F-35s, F-15 Eagle IIs, and other complementary capabilities will provide multiple force package options for commanders.

The F-35A, due to both its warfighting capability and the large capacity we intend to procure, will be the cornerstone of the Air Force's fighter force within that broader portfolio for decades. But like any cornerstone in a house, it must be strong enough to hold up the rest of the Air Force's fighter structure. Highly-contested Chinese and Russian warfighting environments, supported by novel operational concepts and rapid weapons development timelines, define the warfighting challenges we need the F-35 to solve in order to be an effective cornerstone.

Consequently, we need a capable, available, and affordable F-35 to outpace these key competitors and win the high-end fight. The Air Force needs these attributes in the quantities required to deter, compete, and win against any adversary; the Nation expects nothing less of its Air Force.

The F-35 attributes the Air Force needs will also bolster our joint Navy and Marine teammates, seven F-35 international partner nations, and the ever-growing list of Foreign Military Sales customers. The F-35 already makes our joint force and coalitions more effective, lethal, and survivable today. Continued modernization with an emphasis on sustainment and affordability will enhance interoperability and integration across the entire joint and coalition combat force, increasing our collective combat effectiveness. The F-35 will be the fighter aircraft cornerstone for many services and nations – not just the U.S. Air Force – for decades to come. We must get this right, for all of us.

As the Air Force Chief of Staff General CQ Brown wrote in his strategic approach document, *Accelerate Change or Lose*, getting this right means we need to work differently with other Department of Defense stakeholders, the Congress, and our industry partners. The Air Force is committed to working with our teammates testifying here today, and with the Congress, to ensure the Air Force and our joint and international Allies and partners get even more capable, available, and affordable F-35s.

II Capable

Air Force F-35As completed successful, year-and-a-half-long consecutive Middle East combat deployments in October 2020. These deployments generated real-world data to allow us to evaluate the deployed performance of the F-35, learn valuable lessons from long-duration

combat sorties, and mature combat and sustainment concepts in permissive and less contested environments.

The current Block 3F F-35 provides a significant capability improvement over 4th generation aircraft. The aircraft effectively counters the threats it was designed to counter. We know this to be true based upon our experience in operational test, and from combat operations conducted by the United States and Allies within the Syrian Integrated Air Defense System.

That said, peer competitors are aggressively modernizing their forces to counter traditional U.S. asymmetric advantages like stealth fighters, rendering Block 3F F-35s less effective against emerged and evolving high-end threats in 2025 and beyond. Therefore we need Block 4 F-35 modernization, enabled by Technical Refresh-3 (TR-3) hardware, on competition-relevant timelines to ensure continued F-35 relevance against China or Russia. The first Air Force aircraft to deliver with TR-3 is expected in mid-2023. This delivery schedule is assessed to be high risk, with little-to-no margin for unexpected discoveries in qualification or flight test. Block 4 capabilities increase our ability to prosecute targets, increase survivability, enhance interoperability, and improve sustainment. Any additional schedule slips to either TR-3 or Block 4 will increase risk to combat mission accomplishment and to our Airmen.

Beyond critical Block 4 platform and software improvements, we need to accelerate related capabilities. The Air Force also needs a simulator capable of replicating the expected threat environment, both in fidelity and density, to meet full-spectrum training requirements. The planned training system re-architecture should leverage existing F-35 Joint Simulation Environment (JSE) investments and complement ongoing Air Force efforts toward a Common Synthetic Training Environment across weapons systems. Finally, more so than any other fighter in the inventory, F-35 operational performance is wholly dependent upon the availability,

currency, and accuracy of its mission data files. The F-35 electronic warfare reprogramming enterprise must be agile enough to respond to a rapidly evolving threat environment and have sufficient capacity to cope with multiple Block 4 hardware and software configurations by 2024.

III Available

The Air Force needs F-35 squadrons that are fully mission capable across a range of expected missions and available to prevail against peer adversaries under contested logistics, during regional lower-scale contingency operations, and to produce sufficient readiness during peacetime training. While the Air Force faces several F-35 availability challenges, the two most urgent needs involve the F135 engine and the transition from the Autonomic Logistics Information System (ALIS) to the Operational Data Integrated Network (ODIN).

F135 engine issues are a significant challenge to Air Force F-35 readiness today. Current F135 engine removal rates and elevated repair scope are outpacing F135 depot production capacity. As of 08 April 2021, 20 Air Force aircraft are grounded without a serviceable engine. These 20 aircraft include 6 aircraft grounded from months to years awaiting repairs from flight or ground mishaps. Without mitigation, data suggests 20% of the F-35 fleet will be Non-Mission Capable (NMC) by 2025 and 43% will be NMC by 2030. Mitigation planning efforts are well underway and their associated funding requirements are coming into focus for the nations that operate the aircraft, the Joint Program Office (JPO), and industry. The Air Force needs the government and industry team to accelerate an affordable long-term solution while maximizing near-term F-35 availability for operations and training. The Air Force and Navy are also working together with the JPO to develop a revised concept of operations (CONOPs) for engine sustainment that better meets user needs.

The current Lockheed-Martin ALIS architecture limits operational and deployment capability, driving the transition to ODIN. ODIN will eventually provide a smaller, more flexible, and more capable hardware solution, using modern architecture integrating software applications to meet warfighter requirements. The ODIN Capabilities Need Statement (CNS) and User Agreement (UA) have been signed by all F-35 Partners and Services. These documents drive requirements and ensure end users are properly represented throughout the software development and delivery process. The development of ODIN will be delayed and the F-35 enterprise's reliance on ALIS will continue. In the meantime, the Air Force appreciates the program's efforts to enhance ALIS cyber security and to improve the ALIS user experience for our maintenance professionals.

IV Affordable

The Air Force has a finite amount of resources available to procure, operate, and sustain the F-35. If we cannot find ways to make the program significantly more affordable, particularly with respect to total life cycle cost, then we will be forced to make difficult decisions in the coming years to meet our fighter force mix needs.

The Air Force is engaged with the JPO, international partners, and industry teammates to tackle the affordability challenge head on. The F-35 program is experiencing multiple competing affordability pressures that collectively challenge the Air Force, to include higher-than-planned life cycle sustainment costs, TR-3 and Block 4 cost increases, the need for increased propulsion sustainment, ALIS-ODIN transition funding shortfalls, depot stand-up costs, training systems enhancements, mission-data file generation improvements, and procurement of product support technical data from Lockheed-Martin and its suppliers. Additional funding may be required to address some or all of these issues, and we are making

progress on understanding the interdependencies between these categories. As we work through this, the international F-35 partnership is already being forced to make tough choices about where to spend the next strategic dollar. From a holistic perspective, generating and sustaining the combat capability we need requires deliberate planning to alleviate these various pressures.

The Air Force's life cycle affordability challenge is best captured by the Cost Per Tail Per Year (CPTPY) metric as opposed to the Cost Per Flying Hour (CPFH). The Air Force largely agrees with the Government Accountability Office's (GAO) findings about the current and future CPTPY estimates exceeding current Air Force budget projections. The Air Force does not agree with the GAO's recommendation, however, that we should reduce the program of record or flight hours at this time, for two reasons. First, as the GAO report notes, the Air Force program of record was designed to replace the F-16 and A-10 fleets, both of which we will continue to operate for many years to come. This gives the Air Force time to assess the progress of the many cost reduction initiatives, some in work, some yet to come, toward our $4.1M CPTPY affordability target. If we are not making adequate progress as the time nears for the retirement of the F-16 fleet, we could adjust the Air Force program of record or flying hours at that point. Second, adjusting the Air Force program prior to the ultimate F-16 retirement decision could have an impact on the F-35 program's international partnership and the agreement that governs F-35 cost sharing within the partnership.

VII Conclusion

The Air Force is proud of what our Airmen have accomplished with the F-35. We remain absolutely committed to the aircraft as the cornerstone of our and many other nations' combat air forces for decades to come. Much has been accomplished in the last 20 years in F-35, but much work remains. We are fully committed to working differently with other Department

of Defense stakeholders, the Congress, and our industry partners to get this right. It will take our best collective effort to ensure we provide tomorrow's Airmen with the tools they need to deter, compete, and win against increasingly aggressive and competent competitors.

As the program's most demanding customer, the Air Force requests your support in helping the F-35 enterprise deliver the capability, availability, and affordability attributes the Air Force, Navy, Marine Corps, and our Allies and partners need. As the program's staunchest advocate, I hope my testimony today will increase our collective understanding of the unique combat capability the F-35 provides the Nation today, and what we need it prepared to do tomorrow. I look forward to answering your questions during this important hearing.

Brigadier General David W. Abba

Brig. Gen. David W. Abba is the Director of the F-35 Integration Office, Headquarters United States Air Force, the Pentagon, Arlington, Virginia. He advises the Secretary of the Air Force and the Air Force Chief of Staff on the multi- billion dollar F-35 Lightning II program and engages with the Office of the Secretary of Defense, the Joint Strike Fighter Program Office, other services, Air Force major commands and partner and customer nation representatives to advance the operational capabilities and sustainment needs of the F- 35A Lightning II aircraft.

Brig. Gen. Abba earned his commission through the United States Air Force Academy in 1995 with a Bachelor of Science in Human Factors Engineering. He has held a variety of flying assignments at the squadron, group and wing level, including serving as the weapons officer for the 58th Fighter Squadron at Eglin Air Force Base, Florida, director of operations for the 27th Fighter Squadron and commander of the 94th Fighter Squadron, both at Langley AFB, Virginia, and commander of the 3rd Operations Group at Joint Base Elmendorf-Richardson, Alaska. The general's staff assignments include Airpower Strategist in Project CHECKMATE, Assistant Executive Officer to the Air Force Chief of Staff and Senior Air Force Strategy Advisor in the Office of the Secretary of Defense for Policy. Prior to his current position, he was the commander, 53rd Wing, Eglin AFB, Florida.

EDUCATION

1995 Bachelor of Science, Human Factors Engineering, U.S. Air Force Academy, Colorado Springs, Colo.
2002 Squadron Officer School, Maxwell Air Force Base, Ala.
2003 U.S. Air Force Weapons School, Nellis AFB, Nev.
2007 Master of Arts, National Security and Strategic Studies, College of Naval Command and Staff, Naval Station Newport, R.I.
2007 Naval Operational Planner Course (now Maritime Advanced Warfighting School), Naval Station Newport, R.I.
2008 Air War College, Maxwell AFB, Ala., by correspondence
2013 Master of Science, National Resource Strategy, Dwight D. Eisenhower School for National Security and Resource Strategy, Fort Lesley J. McNair, Washington, D.C.
2015 Fellow, Seminar XXI, Massachusetts Institute of Technology, Washington, D.C.

ASSIGNMENTS

July 1995–May 1996, Intercollegiate Program Manager, Athletic Department, U.S. Air Force Academy, Colorado Springs, Colo.
May 1996–September 1997, Student, Undergraduate Pilot Training, Naval Air Station Whiting Field, Fla., and Vance Air Force Base, Okla.
September 1997–December 1997, Student, Introduction to Fighter Fundamentals, Columbus AFB, Miss.
January 1998–June 1998, Student, F-15C Formal Training Unit, 2nd Fighter Squadron, Tyndall AFB, Fla.
July 1998–February 2001, F-15C Instructor Pilot, 71st Fighter Squadron, Langley AFB, Va.
March 2001–June 2003, F-15C Instructor Pilot and Academic Instructor, 95th Fighter Squadron, Tyndall AFB, Fla.
July 2003–December 2003, Student, U.S. Air Force Weapons School, Nellis AFB, Nev.
January 2004–June 2006, Squadron Weapons Officer, 58th Fighter Squadron and Wing Weapons Officer, Eglin AFB, Fla.
July 2006–September 2007, Student, College of Naval Command and Staff and Naval Operational Planner Course, Naval Station Newport, R.I.
September 2007–March 2009, Airpower Strategist, CHECKMATE and Assistant Executive Officer to the Chief of Staff, U.S. Air Force, the Pentagon, Arlington, Va.
July 2009–June 2012, Operations Officer, 27th Fighter Squadron; Commander, 94th Fighter Squadron; Deputy Commander, 1st Operations Group, Langley AFB, Va.
July 2012–June 2013, Student, Dwight D. Eisenhower School for National Security and Resource Strategy (formerly ICAF), Fort Lesley J. McNair, Washington, D.C.

June 2013–May 2015, Senior Air Force Strategy Advisor, Office of Strategy and Force Development, Office of the Secretary of Defense for Policy, the Pentagon, Arlington, Va.
May 2015–June 2017, Commander, 3rd Operations Group, Joint Base Elmendorf-Richardson, Alaska
June 2017–June 2019, Commander, 53rd Wing, Eglin AFB, Fla.
July 2019–present, Director, F-35 Integration Office, headquarters U.S. Air Force, the Pentagon, Arlington, Va.

SUMMARY OF JOINT ASSIGNMENTS
June 2013–May 2015, Senior Air Force Strategy Advisor, Office of Strategy and Force Development, Office of the Secretary of Defense for Policy, the Pentagon, Arlington, Va. as a lieutenant colonel and colonel

FLIGHT INFORMATION
Rating: command Pilot
Flight Hours: more than 2,100
Aircraft Flown: T-38A, AT-38B, F-22A, F-15C/D/E, F-16D, E-3B/C, C-12F, C-17A, B-1B, B-2A, B-52H, HC-130J, HH- 60G, TU-2S, E-9A

MAJOR AWARDS AND DECORATIONS
Defense Superior Service Medal
Legion of Merit with oak leaf cluster
Meritorious Service Medal with three oak leaf clusters
Air Medal
Aerial Achievement Medal
Air Force Commendation Medal with oak leaf cluster
Air Force Achievement Medal
Joint Meritorious Unit Award
Air Force Outstanding Unit Award with three oak leaf clusters
Air Force Organizational Excellence Award

OTHER ACHIEVEMENTS
2002 Distinguished Graduate, Squadron Officer School, Maxwell Air Force Base, Ala.
2003 Flying Award, U.S. Air Force Weapons School, Nellis AFB, Nev.
2007 Distinguished Graduate, College of Naval Command and Staff, Naval Station Newport, R.I.
2013 Distinguished Graduate, Dwight D. Eisenhower School for National Security and Resource Strategy, Fort Lesley J. McNair, Washington, D.C.

EFFECTIVE DATES OF PROMOTION
Second Lieutenant May 31, 1995
First Lieutenant May 31, 1997
Captain May 31, 1999
Major Aug. 1, 2005
Lieutenant Colonel Mar. 1, 2009
Colonel Oct. 1, 2014
Brigadier General Nov. 2, 2019

(Current as of November 2019)

DOCUMENTS SUBMITTED FOR THE RECORD

APRIL 22, 2021

Section 1: Incentivized Metrics

The following provides the metrics that were defined and negotiated on the FY20A sustainment contract in Period of Performance from January 2020 to December 2020:

Air Vehicle Performance Metrics

Following provides the definitions of each metric and the calculation equations.

Mission Capable (MC) – MC Rate is the percentage of Possessed Time that the Air Vehicle is capable of performing at least one (1) of its applicable missions as listed in the MEFL

$$MC = \frac{Uptime}{Uptime\ plus\ Downtime}$$

Full Mission Capable (FMC) – FMC Rate is the percentage of Possessed Time that the Air Vehicle is capable of performing all applicable missions as listed in the MEFL

$$FMC = \frac{FMC\ \ Uptime}{Total\ Uptime\ plus\ Total\ Downtime}$$

Gross Issue Effectiveness (GIE) Air Vehicle Gross Issue Effectiveness (GIE) measures how effective the inventory that is being maintained in retail at the bases is supporting operational demands. Higher GIE equates to better performance. Air Vehicle Gross Issue Effectiveness is determined as a percentage that is calculated by the total number of demands filled at the base with onsite inventory, divided by the total number of demands (demands filled at base with onsite inventory plus demands filled regionally through the global spares pool).

$$GIE = \frac{Total\ Number\ Demands\ Filled\ locally}{Total\ Demands}$$

Customer Wait Time (CWT) Air Vehicle Customer Wait Time (CWT) measures how quickly the supply chain is able to respond to operational demands when an item is not available in retail supply at the bases.

$$CWT = Time\ between\ Requisition\ Create\ Date\ to\ Requisition\ Delivery$$

Training Effectiveness (TE) TE is defined as the availability of the Full Mission Simulator (FMSim) to complete scheduled missions versus the number of scheduled missions.

$$TE = \frac{Total\ completed\ mission\ events - delayed\ or\ interrupted\ events}{Total\ scheduled\ events}$$

Air Vehicle Gross Issue Effectiveness (GIE) measures how effective the inventory that is being maintained in retail at the bases is supporting operational demands. Higher GIE equates to better performance.
Air Vehicle Gross Issue Effectiveness is determined as a percentage that is calculated by the total number of demands filled at the base with onsite inventory, divided by the total number of demands (demands filled at base with onsite inventory plus demands filled regionally through the global spares pool).

Air Vehicle Customer Wait Time (CWT) measures how quickly the supply chain can respond to operational demands when an item is not available in retail supply. Lower CWT equates to better performance.
Air Vehicle Customer Wait Time is measured in days from Requisition Create Date to Requisition Delivery Date for all requisitions determined to be sourced from outside the local base retail inventory. For purposes of PBL Performance measurement, CWT is measured by the percent of closed ALIS requisitions that are fulfilled within a defined target number of days for the given period and is agnostic of if inventory is on hand in the global pool or not.

- Priority 1 is NMCS aircraft (part not on site)for assigned mission Pick/Pack cycle time is 1 hour to have in supply
  - Pri-1 6 day delivered within 6 days
  - Pri-1 10 day delivered between 6 and 10 days

- Priority 2 is PMCS aircraft (parts not on site, but aircraft mission capable) per assigned mission
  - Pri-2 10 day delivered with 10 days
  - Pri-2 30 day delivered between 10 and 30 days

Section 2: CY2020 Performance

In support of the fleet requirements to meet CY2020 mission requirements, the FY20A Sustainment Contract was awarded in December 2019. This sustainment contract incentivized the contractor to support fleet performance readiness thresholds in Mission Capable (MC) rates and Full Mission Capable (FMC) Rates along with Supply functions for Gross Issue Effectiveness (GIE) and Customer Wait Times (CWT). Performance incentives were awarded based on the contractor's ability to meet the required thresholds agreed to in pre-contract negotiation portion of the contracting process.

In each quarter, the contractor's performance is assessed to determine whether they met, exceeded, or failed to meet the government requirements. The contractor is held accountable and no incentive is awarded if requirements are not achieved at any time during the quarter. The tables below show the Incentive Fee available and earned, by F-35 Variant, in 2020.

CY20 Performance Metrics

F-35A CY2020 Incentive Fee Earned					
POP1					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	70%	80%	$4,348,398	$4,212,511	96.9%
FMC	40%	50%	$4,348,398	$4,348,398	100%
POP2					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	70%	80%	$4,679,649	$4,679,649	100%
FMC	40%	50%	$4,679,649	$4,679,649	100%
POP3					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	70%	80%	$4,886,,442	$4,733,741	96.9%
FMC	40%	50%	$4,886,,442	$4,886,442	100%
POP4					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	70%	80%	$5,233,012	$5,233,012	100%
FMC	40%	50%	$5,233,012	$5,233,012	100%

Table 1-1 – F-35A Air Vehicle Metric CY2020 Incentive Fee

F-35B CY2020 Incentive Fee Earned					
POP1					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	68%	80%	$1,484,717	$1,224,892	82.5%
FMC	23%	33%	$1,484,717	–	0%
POP2					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	68%	80%	$1,544,699	$1,274,377	82.5%
FMC	23%	33%	$1,544,699	–	0%
POP3					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	68%	80%	$1,631,125	$1,223,344	75%
FMC	23%	33%	$1,631,125	–	0%
POP4					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	68%	80%	$1,789,143	$1,386,586	77.5%
FMC	23%	33%	$1,789,143	–	0%

Table 1-2 – F-35B Air Vehicle Metric CY2020 Incentive Fee

CY20 Performance Metrics

F-35C CY2020 Incentive Fee Earned					
POP1					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	65%	80%	$598,974	–	0%
FMC	15%	30%	$598,974	–	0%
POP2					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	65%	80%	$641,159	–	0%
FMC	15%	30%	$641,159	–	0%
POP3					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	65%	80%	$681,248	–	0%
FMC	15%	30%	$681,248	–	0%
POP4					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
MC	65%	80%	$698,803	–	0%
FMC	15%	30%	$698,803	–	0%

Table 1-3 – F-35C Air Vehicle Metric CY2020 Incentive Fee

CY20 Performance Metrics

Supply CY2020 Incentive Fee Earned					
POP1					
Metric	Threhold	Objective	Available Fee	Fee Earned	% Fee Earned
GIE	72%	82%	$919,080	$804,195	87.5%
CWT PRI 1 6 dAY	70%	80%	$1,102,896	$1,068,431	96.9%
CWT PRI 1 10 dAY	80%	90%	$827,172	$775,474	93.8%
CWT PRI 2 10 Day	65%	75%	$551,448	–	0%
CWT PRI 2 30dAY	80%	90%	$275,724	$241,259	87.5%
POP2					
Metric	Threhold	Objective	Available Fee	Fee Earned	% Fee Earned
GIE	72%	82%	$980,352	$857,808	87.5%
CWT PRI 1 6 dAY	70%	80%	$1,176,422	$1,176,422	100.0%
CWT PRI 1 10 dAY	80%	90%	$882,317	$882,317	100.0%
CWT PRI 2 10 Day	65%	75%	$588,211	–	0%
CWT PRI 2 30dAY	80%	90%	$294,106	$248,152	84.4%
POP3					
Metric	Threhold	Objective	Available Fee	Fee Earned	% Fee Earned
GIE	72%	82%	$1,028,322	$867,647	84.4%
CWT PRI 1 6 dAY	70%	80%	$1,233,986	$1,233,986	100.0%
CWT PRI 1 10 dAY	80%	90%	$925,489	$925,489	100.0%
CWT PRI 2 10 Day	65%	75%	$616,993	–	0%
CWT PRI 2 30dAY	80%	90%	$308,496	$279,575	90.6%
POP4					
Metric	Threhold	Objective	Available Fee	Fee Earned	% Fee Earned
GIE	72%	82%	$1,103,299	$930,909	84.4%
CWT PRI 1 6 dAY	70%	80%	$1,323,959	$1,323,959	100.0%
CWT PRI 1 10 dAY	80%	90%	$992,969	$992,969	100.0%
CWT PRI 2 10 Day	65%	75%	$661,980	$413,738	63%
CWT PRI 2 30dAY	80%	90%	$330,990	$299,960	90.6%

Table 1-1 – Supply Metric CY2020 Incentive Fee

Training Effectiveness CY2020 Incentive Fee Earned					
POP1 THRU POP4					
Metric	Threshold	Objective	Available Fee	Fee Earned	% Fee Earned
TE	85%	90%	$4,031,052	$4,031,052	100%

Table 1-1 – Training Effectiveness CY2020 Incentive Fee

Section 3: Metrics Achieved

MC and FMC metrics were assessed at the variant level for all active F-35A, F-35B, and F-35C aircraft. The figures below provide historical Calendar Year 2019 and 2020 achieved performance by month.

CY20 Performance Metrics

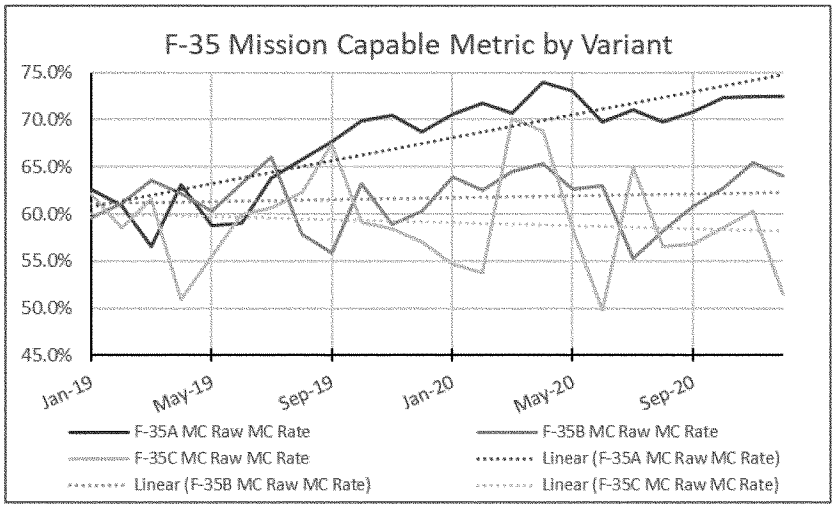

Fig 1-1 - Mission Capable Rates

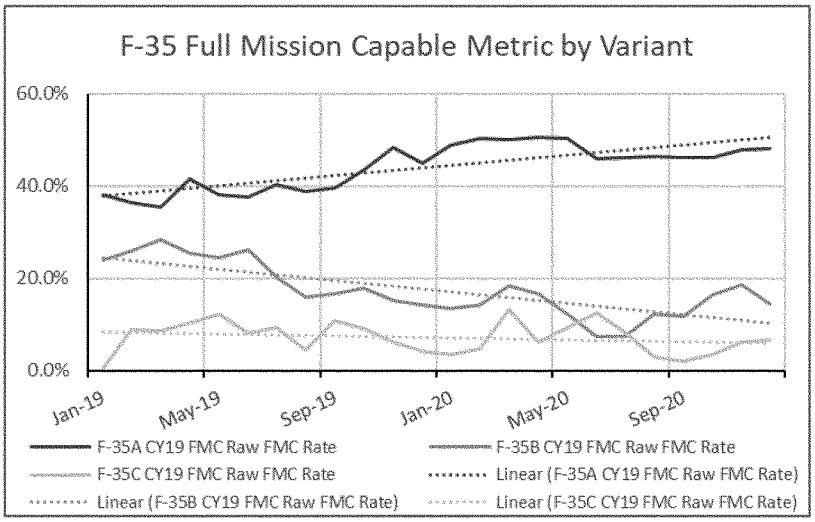

Fig 1-2 – Full Mission Capable Rates

CY20 Performance Metrics

GIE and CWT metrics were assessed at the variant level for all active Fleet aircraft. The figures below provide historical Calendar Year 2019 and 2020 achieved performance by month.

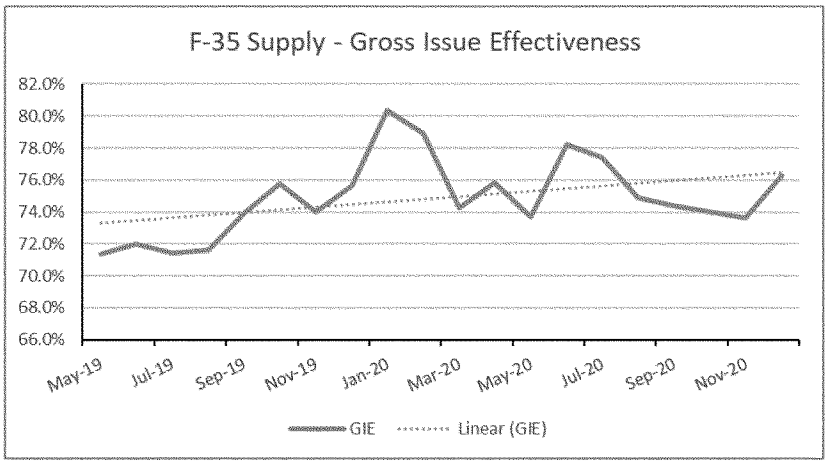

Fig 1-3 – Supply – Gross Issue Effectiveness (Fleet)

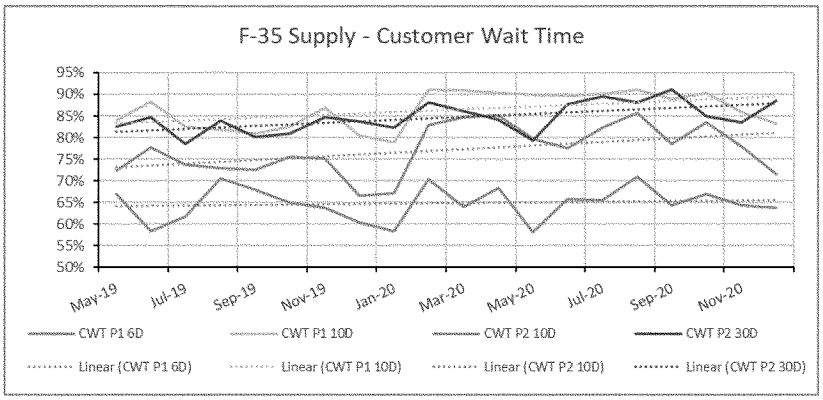

Fig 1-4 – Supply – Customer Wait Time Priorities

We implemented the F-35 Full Mission Simulator (FM-SIM) Training Effectiveness (TE) metric in CY2020. The TE metric was assessed quarterly at site level. The Figure below provides historical Calendar Year 2020 achieved performance.

CY20 Performance Metrics

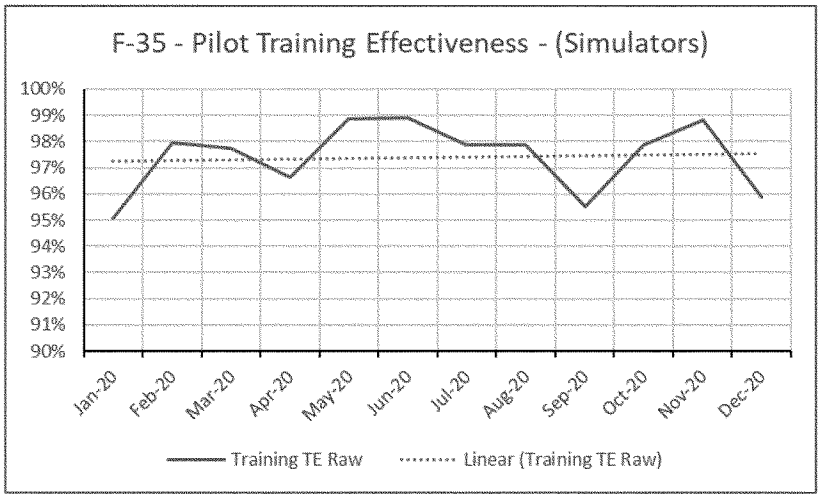

Fig 1-5 – Pilot Simulator Training Effectiveness

Summary

In summary, the figures above enable trend analysis and help visualize achieved metrics over the period of performance for CY2019 and CY2020. Some of the trends identified in these metrics are:

- Fleet reported metrics for the F-35A MC and FMC identified in figure 1-1 and 1-2 respectively, illustrated an upward trend showing positive impact for incentivized metric
- The fleet reported metrics for the F-35B MC in figure 1-1 illustrates a slight upward trend whereas FMC in figure 1-2 has a slight downward trend resulting in no incentive for the contractor
- Data reported in figure 1-1 for the F-35C MC showed a downward trend resulting in no incentive, and F-35C FMC was consistent with a straight trend line, resulting in no incentive awarded
- Fleet Supply (GIE) in figure 1-3 illustrates an upward trend or steady improvement, throughout the CY2019 and CY2020.
- The Supply priority metrics for reported CWT, (P1 6D, P1 10D, P2 10D and P2 30D), of figure 1-4, illustrate an upward trend throughout CY2019 and CY2020.
- Pilot Training Effectiveness (TE) metric, figure 1-5, represents the simulator training scheduled and a steady state of simulator availability and training accomplished events during CY2020.

Metric trends indicate that the incentivized metrics had a positive effect on contractor performance in the MC, Supply, and Training efforts with no positive impacts in the FMC metrics. Future contracts must focus on the positive behaviors exhibited within the CY2020 PoP. Future PBL contracts should provide incentives where the contractor had the majority of control and can provide behavioral impacts for increased fleet performance. Improving fleet performance is a team sport, and the JPO and its global team of acquisition experts, sustainers, and warfighters will continue to work with our contractors on a combined Contractor/Fleet team effort in driving improvement across all performance metrics.

WITNESS RESPONSES TO QUESTIONS ASKED DURING THE HEARING

APRIL 22, 2021

RESPONSES TO QUESTIONS SUBMITTED BY MR. NORCROSS

Mr. ULMER. In line with Department of Defense guidance, Lockheed Martin continues moving away from Turkish suppliers as their existing contracts expire and fully qualified alternatives are identified. At the time of the hearing, we had stood up alternate sources for 814 of 817 parts. The qualification effort has since completed, and we now have a qualified non-Turkish source available for all 817 parts. Final delivery from Turkish suppliers is forecasted to be the end of March 2022. When it comes to the split of domestic versus foreign sources, the new alternative sources are split 56% domestic sources and 44% international sources. Of note: 24% of the total sources in Turkey are Fokker harnesses. These were dual sourced in the Netherlands and Turkey and are all now single sourced in the Netherlands. [See page 34.]

Mr. BROMBERG. The 188 parts referenced during the testimony were re-sourced, with most now being resourced to multiple suppliers, resulting in 377 total part number resourcing efforts, with roughly 77% going to U.S. sources and the remaining 23% to international sources. A breakdown by part number and percentage can be found below. Note for none required below, the two parts in question had multiple sources, including one non-Turkish source, and the additional load was given to the other existing source.

	# PNs	% by Country
Canada	20	5.9%
Israel	2	0.6%
Netherlands	42	12.5%
USA	259	76.9%
Italy	11	3.3%
Australia	1	0.3%
None required	2	0.6%
	337	100%

USA	**77%**
International	**23%**

[See page 35.]

General FICK. The DOD Joint Service Specification Guide (JSSG–2007A) provides the framework for the sand ingestion requirement for the JSF Propulsion System's Performance-Based Specification.

The F135–PW–100 (CTOL/CV) engine successfully passed the sand ingestion testing requirement defined in JSSG 2007C of 2 hours of fine and coarse sand concentration while the F135–PW–600 (STOVL) passed a test that covered specific Middle East sand composition in addition to the coarse and fine sand. Both engines maintained their structural integrity and at least 90% of intermediate thrust and operability requirements throughout this testing—passing the JSF Propulsion Performance Based Specification requirement.

With that said, the JSSG–2007C and previous specification guides did not adequately define test protocols sufficient to identify unique chemical vulnerabilities with respect to the turbine coatings and the time required for these vulnerabilities to manifest in all environmental conditions. DOD has only started to understand the nature of durability vulnerabilities and the ways to verify them in the past decade. In light of this learning process, the JPO subjected the F135 to coarse, fine and Middle East sand particle tests. The engine successfully passed these qualification requirements. Subsequently, in 2018, investigations into Israeli engines suffering from early turbine coating degradation identified the top layer of the thermal barrier

coating susceptibility to Middle East sand chemical composition. Pratt & Whiney addressed this susceptibility with a new engineering configuration coating change to a more Middle East sand resistant coating. These changes were incorporated into the production engines in January 2020, and into engine spares in May 2020 [See page 48.]

RESPONSE TO QUESTIONS SUBMITTED BY MR. BACON

Mr. ULMER. The UAE program will deliver aircraft in the latter half of the decade—after the overall F–35 program has reached peak production rate and is coming down in yearly delivery aircraft quantities, having satisfied early U.S. and partner demand for recapitalizing their 4th generation fighter fleets. The F–35 production system is designed to work most efficiently near the peak rate of 156 aircraft per year. This production system includes a vast diverse supply chain that is roughly 75% U.S. suppliers and 25% international. As the overall program comes down from peak capacity there will be cost pressure to keep this global production system at peak efficiency. While the UAE program details are still being finalized, we believe aircraft deliveries will occur at approximately 10 aircraft per year for a 5-year period and could represent a significant savings to all our customers. While the savings in sustainment arena are harder to quantify, we believe it is generally accepted that there will be savings due to larger critical mass and improved logistics and repair efficiencies associated with fundamental economic order of quantities benefit [See page 37.]

RESPONSE TO QUESTIONS SUBMITTED BY MR. BERGMAN

Mr. BROMBERG. There is a PW engine model in the simulator that Lockheed Martin pays a license fee for; however, nothing related to the model is causing a delay. [See page 36.]

RESPONSE TO QUESTIONS SUBMITTED BY MS. SHERRILL

Mr. ULMER. The tyranny of distance and the adversary threats in the INDOPACOM AOR are challenging and stressing for all platforms—even the most advanced 5th gen and next gen weapons systems still in development. The F–35 is an affordable, lethal, and survivable platform capable of operating at the edge of the fight—and it is present and capable today in numbers. The aircraft has ability to carry both long-range weapons and fuel tanks that extend range in an operationally significant fashion. To address your weapons question directly, the F–35 is currently able to carry four advanced medium-range air-to-air missiles (AMRAAM) within the weapons bays of the aircraft and two advanced short range (Sidewinder) missiles externally. Both of these Block 3 capabilities are being upgraded in Block 4 to network-enabled capability and several other improvements to their functionality and lethality that are expected to deliver mid-2024. Moreover, the Joint Program Office has recently committed to proceeding with a program that will increase the internal carriage capability of AMRAAM for F–35A and F–35C. F–35 currently carries six 500# class weapons, including GBU–12 and the moving-target capable, dual-mode, GBU–49. It also has capability to carry two 1000# or 2000# class GPS-Guided weapons, in addition to the Joint Standoff (glide) Weapon (JSOW). The F35A also carries the Small Diameter Bomb I. Block 4 will add two improved air-ground capabilities to U.S. aircraft. First is addition of the quad-pack, tri-mode seeker, Small Diameter Bomb (SDB II), which basic capability is expected to deliver to the F–35B in 2022, with full network-enabled capability to all three variants in 2024. Second is the addition of Laser Joint Direct Attack Munition (LJDAM). Finally, two additional capabilities are in risk reduction phase, which will bring advanced seeker and standoff capabilities to the aircraft. Advanced Anti-Radiation Guided Missile is a replacement for the current HARM system with increased range and other capabilities. Joint Air-Surface Standoff Missile (JASSM) has three variants and would bring a standoff capability to the F–35, albeit external only, and we appreciate Congress providing $10 million in Fiscal Year 2021 to support the integration of JASSM onto the F–35. Lastly, the aircraft will be undergoing a modification in Lot 15 that will provide structural modification to the weapons bays that will enable increased internal air-air carriage as well as Advanced Anti-radiation Guided Missile (AARGM.) LM is investing strongly in these future capabilities, and in the digital transformation methods that will enable more rapid integration onto the platform. Our analysis shows that 5th generation weapons combined with 5th generation aircraft provides a clear advantage and is a game-changer for the warfighter. Therefore, F–

35 advanced capability insertion programs are underway to maintain the technological "step ahead" of peer adversaries. The delivery of these cutting-edge warfighting technologies is needed to outpace rapidly advancing Chinese and Russian technologies—they are a national security imperative and offer the cheapest path to deter adversaries. Wargames that play jets without these capabilities tell the story of why we need to consciously invest to pace the rapid technological developments of peer adversaries. Now, more than ever, we need to fund the development of advanced capabilities that keep us ahead of the threat and at the lowest cost-per-effect [See page 29.]

RESPONSE TO QUESTIONS SUBMITTED BY MR. MOORE

Mr. ULMER. TR3 Hardware is planned for delivery beginning in Lot 15 in 2023. There is schedule risk that we are working closely with the JPO and the USAF to mitigate. It is Lockheed Martin's plan and intent to deliver TR3 configured aircraft per the requirements in our Lot 15 contract. Aircraft delivered prior to Lot 15 are candidates for updates, with each customer defining their retrofit requirement. It is our understanding that the USAF intent is to bring the majority of their F–35 fleet up to a TR–3 baseline. Retrofits are planned to begin in 2024. The USAF is best suited to answer the specifics of this question. Block 4 capabilities are delivered with both hardware and software, with Block 4 capabilities delivering to the warfighter now via software and continuing through hardware updates planned for upcoming Lots. We have had ongoing dialog with the Air Force from the technical engineering standpoint for retrofit of TR–3 and Block 4 capabilities for their fleet of F–35s. At this time, I would have to defer to the USAF for the extent of future retrofits [See page 40.]

RESPONSES TO QUESTIONS SUBMITTED BY MR. GARAMENDI

General FICK. *Purpose* The purpose of the white paper is to provide information related to F–35 variant and fleet level performance metrics, and the Fee earned associated with that performance in 2020.

This document identifies the metrics used in the CY20 Annualized Sustainment Contract in Section 1. Section 2 includes tables that show how performance against those metrics was reflected in fee CY20 Performance Metrics awarded. Finally, Section 3 shows a time history of select metrics, comparing performance in CY20 with that in CY19. [See page 52.]

[The document referred to can be found in the Appendix on page 179.]

General FICK. The four major areas of sustainment cost mentioned in the hearing include: 1) airframe parts and repairs; 2) engine parts and repairs; 3) organic manpower & operations; and 4) sustaining support. In general, total aircraft inventory (TAI) and flight hours (FH) are the most significant drivers of these costs, but utilization rates and timeline of operations are also major components. Lower level drivers also exist and are discussed below. The JPO has initiatives underway to actively reduce or optimize the costs in each of these areas.

1. The first area of cost is airframe parts and repairs and refers to the Lockheed Martin (LM) costs associated with maintenance. It includes organizational maintenance and support (i.e. the cost of materials and other costs used to maintain the system) as well as costs related to component depot maintenance. The main cost drivers for this area are component repair and replenishment pricing, and part reliability. These maintenance related costs are expected to contribute 16% of the CPTPY metric at Steady State (DOD FY36–37) in CY12$.
2. The second area of cost is engine parts and repairs and refers to the Pratt and Whitney (P&W) costs associated with maintenance. For the P&W scope, the main cost drivers include scheduled engine overhauls and unscheduled repairs. These maintenance related costs are expected to contribute 18% of the CPTPY metric at Steady State (DOD FY36–37) in CY12$.

   The JPO has instituted several programs aimed at reducing these costs. With LM, the Reliability and Maintainability Improvement Program (RMIP) identifies and selects parts and/or processes which, when improved, lead to increased aircraft availability and/or reduced cost. A similar program exists for Propulsion, the Component Improvement Program (CIP), which drives reduction in parts consumption by improving engineering performance. Additional projects are underway throughout the program to improve reliability, expand repair capacity and velocity, and reduce repair timelines.

3. The third area of cost is organic manpower and operations and refers to the cost of operators, maintainers, and other support labor such as security, logistics, safety, and engineering assigned to operating units. The other significant portion of this cost is unit-operating material, which is largely fuel. The main cost drivers in this area are the number of maintainers at the squadron level and fuel consumption. These unit level costs are expected to contribute 25% for manpower, and 16% for operations, of the CPTPY metric at Steady State (DOD FY36–37) in CY12$.

   The JPO, alongside LM, P&W, and the U.S. Services are actively working to enable the reduction of unit level (organic) manpower and fuel consumption required for the F–35. In winter of 2020, the JPO kicked off an initiative to examine the current levels of organic labor assigned to F–35 units. Specifically, business cases are underway to understand prioritization of Prognosis Health Management (PHM) requirements to enable labor efficiency by providing a more user friendly and maintainable aircraft. The team is also examining man-hours to complete tasks with the focus on best practices across the F–35 enterprise that promulgate thru training and tech pub updates. The Services are also performing labor studies to understand how to optimize labor within the units. Lastly, the JPO and P&W are exploring key initiatives such as the Compressor High Efficiency 3–D Aero initiative which should improve durability in the compressor, combustor, and turbine and have a direct impact on fuel requirements.
4. The fourth area of cost is Sustaining Support, which provides the required support labor that enables aircraft operations and maintenance. A key driver in this area is shared labor to support enterprise operations, sustaining engineering, and logistics and unique labor to support site and squadron operations. For F–35, the bulk of these costs are found in the personnel on the flight line and are composed of LM and P&W field service engineers, field service representatives, and ALIS administrators, as well as instructors and training & course materials. These costs are expected to contribute 13% of the CPTPY metric at Steady State (DOD FY36–37) in CY12$.

   The JPO has several initiatives across the enterprise aimed at reducing this portion of sustainment cost. One of the most important initiatives is the ALIS to ODIN evolution, which aims to reduce the ALIS labor footprint and achieve higher levels of efficiency and availability on the flight line. Another example of a JPO program aimed at reducing costs is the development of the F–35's Next Gen Mission Planning Program. This critical development effort is focused on reducing the number of Offboard Mission Support (OMS) administrators through a deliberate reduction in the F–35's mission planning hardware footprint and on upgrading the aircraft's mission planning software architecture to make it easier for mission planning teams to program operational missions. Finally, the Training Systems program office is working to implement the Lightning Learning Environment initiative to streamline training activity for the pilots and maintainers.

The remaining areas of sustainment cost related to CPTPY are for the cost of hardware and software updates that occur after fielding, and the government non-maintenance consumables, transportation & warehousing, demilitarization, and disposal. These costs are expected to contribute the remaining 12% of the CPTPY metric at Steady State (DOD FY36–37) in CY12$ [See page 67.]

QUESTIONS SUBMITTED BY MEMBERS POST HEARING

APRIL 22, 2021

QUESTIONS SUBMITTED BY MR. TURNER

Mr. TURNER. Mr. Ulmer, in the opening statements of the hearing last week there were a few items on operations and support costs that I would like you to respond to regarding operations and support cost:

(1) has additional aircraft added to the production line impacted your ability to scale to support the F–35 operational fleet, If so—how, and if not, what are the biggest challenges to scaling to support the sustainment enterprise for the program; and

(2) compared to the cost to the cost of fourth generation aircraft (defining assumptions you make to compare apples to apples across the various aircraft programs) how does the current operations and support costs today (TY$) for the F–35 compare to other aircraft programs like the F–15C, F–15EX, and F–16.

Mr. ULMER. *(1) has additional aircraft added to the production line impacted your ability to scale to support the F–35 operational fleet . . . If so—how, and if not, what are the biggest challenges to scaling to support the sustainment enterprise for the program*

The additional aircraft delivered each year from production has not impacted our ability to scale the fleet. We have been planning for that production ramp and have been able to deliver the infrastructure to support the delivery of those jets to our customers. As we added 120 aircraft to the fleet in 2020 and another 134 in 2019, we have been able to deliver consistent and improved readiness levels to meet our contractual commitments and reduce our O&S CpFH each year for the last 5 years and by a total of 44% since 2015. The biggest challenge facing the programs ability to improve aircraft readiness today is having the required dedicated repair capacity for the total demands forecasted to support the global fleet. Today, the USG component repair depots once fully operational by late 2024 are projected to only be able to support between 40–50% of the global fleet demands. We are actively working with the JPO on solutions to augment the organic capacity with both international component repair and repair capacity at our suppliers. LM believes we must partner with the USG to not only ensure we are developing the organic capabilities within the DOD, but ensuring we have enough capacity to meet the repair demands of the entire global F–35 enterprise.

(2) Compared to the cost to the cost of fourth generation aircraft (defining assumptions you make to compare apples to apples across the various aircraft programs) how does the current operations and support costs today (TY$) for the F–35 compare to other aircraft programs like the F–15C, F–15EX, and F–16.

LM has insight into the F–35 cost we control and manage, but enterprise cost values to include propulsion, DOD operational costs, as well as costs of other weapon systems should be provided by the U.S. government. LM does not have access to that information or the USG cost reporting systems. Additionally, comparing "apples to apples" of 4th and 5th gen aircrafts has proven to be difficult because of the different sustainment solutions, advanced capabilities internal to the F–35 and how the Services aggregate and report O&S costs across the various weapon systems. For example, an F35A coming off the production assembly line has all of the sensor and weapons capability built into the airframe, within the skin of the aircraft, to execute the mission sets. For legacy 4th generation aircraft this is not the case. The 4th generation sensors and pylons are procured and sustained separately from the aircraft in terms of acquisition and O&S cost.

Mr. TURNER. Lieutenant General Fick, Lockheed Martin stated several times that it has reduced the cost of the portion of the operations and support cost that it controls by 44% over the last 5 years, and will reduce another 40% over the next 5 years. What has the government and Pratt & Whitney done in that same timeframe to attack costs that they control, and actions that are planned for the next 5 years to attack sustainment costs. Mr. Bromberg, please provide your response to the portion of the costs that Pratt & Whitney controls.

General FICK. Affordability is one of the top priorities for the F–35 program and the stand-up of the F–35 Affordability Directorate has provided a centralized team

to provide support to Program Management Offices (PMOs) to address our affordability challenges. The F–35 JPO, through the Affordability Directorate, is currently updating the F–35 Enterprise Affordability Strategy document. The updated strategy spans the entire life cycle and maps each of the five PMOs' cost reduction initiatives, timelines, resource requirements, assumptions, and risks against applicable affordability targets and Service provided affordability constraints. The JPO Executive Leadership Team and Propulsion PMO understand the criticality of targeting affordability in the Propulsion system; propulsion costs comprise a full 20% of our sustainment costs, and costs are projected to grow over the next 10–15 years.

Pratt & Whitney (P&W) content comprises 20% of DOD Steady State (FY36–37) CPTPY(CY12$). The program currently assesses the propulsion contribution to total Cost Per Flying Hour (CPFH) will increase from $4.7K[1] in 2021 to $6.2K in 2033 (CY12$), based on the program's initial wave of scheduled engine overhauls. Recognizing this unacceptable cost growth, the Propulsion PMO and Affordability Directorate are taking proactive actions to reverse this course in order to achieve the Service's Affordability Constraints.

To help drive affordability into the program, the Propulsion PMO has established CPFH and Cost Per Tail Per Year (CPTPY) targets. The near-term target is to reduce the propulsionrelated CPFH by 30% over the next five years (by 2025); long-term targets are still in work. In the pursuit of these targets, the Propulsion team is assessing 64 individual initiatives through the affordability process; those selected for implementation should be fielded within the next five years.

The Propulsion PMO is dedicated to meeting their cost targets and effectively executing the path forward, utilizing and maturing the Battle for Billions (BfB)[2] Propulsion Affordability plan. The BfB Affordability plan is a newly established, long-term affordability initiative that specifically looks at sustainment cost savings in scheduled and unscheduled overhauls. It is founded upon lessons learned and cost savings discovered from the F–22 Raptor engine program.

Propulsion Costs Decreased Over the Last Five Years

Despte the projections at steady state, the JPO and P&W have already collaborated to jointly achieve a 35% reduction in DOD CPFH over the course of the last five years.

DoD F-35 Annual Sustainment (CPFH TY$K)

DoD F-35	FY15A	FY16A	FY17A	FY18A	FY19A	FY20A
Pratt & Whitney	6.0	5.8	5.6	4.8	4.5	3.9

Table numbers are in TY$K and reflect contracted values.

Propulsion Costs Over the Next Five Years

Looking at the next five years, the Propulsion PMO has established a 30% CPFH reduction target. In pursuit of this target, the Propulsion PMO is assessing 64 Cost-Reduction Initiatives (CRIs), Component Improvement Program (CIP) activities, and Research and Technology (R&T) initiatives to actively reduce or optimize the costs associated with Propulsion sustainment. These initiatives include collaborative modifications to our annual sustainment contract to motivate cost reduction initiatives in the 2022–2025 timeframe, with focus areas on Power Module Overhaul, Depot Cost & Repairs, Material Cost, and engine Time on Wing.

The table below highlights the status of the 64 initiatives in the Affordability process, along with their estimated Year of Fleet fielding. 49 of the 64 initiatives are funded and the PMO is assessing options to fund the remaining 15 CRIs.

[1] $4.7k and $6.2k comes from ACE 2021v1.0

[2] Program to utilize lessons learned accomplishments, based on legacy systems like the F119 Affordability reduction successes.

	FLEET FIELDING YEAR					TOTAL
	2021	2022	2023	2024	2025	
CRIs	4	4	3	1	3	15
CIP	8	12	12	11	5	48
R&T					1	1
Total	12	16	15	12	9	64

The initiatives can be grouped into the following areas:

a. Parts Price & Quantity Reduction: Maximizing the CIP, which drives reduction in parts consumption by improving engineering performance.

b. Decrease Maintenance Costs:

i. Specific programs to improve reliability, expand repair capacity and velocity, and reduce repair timelines

ii. Focus on reducing costs and timing of unscheduled engine overhauls

iii. Focus on decreasing the engine maintenance costs

c. Sustainment performance and cost improvements such as small maintenance plan changes implemented through Joint Technical Data updates, process improvements implemented through Sustainment Operating instructions, Data Quality and Integrity Management process improvements and provisioning/Logistic Control Number change.

d. Key cost reduction initiatives that are targeting improving durability in the compressor, combustor, and turbine that have a direct impact on fuel requirements.

e. Utilization of PBL Contracting Strategy; the objective of the PBL will be to increase material availability; decreased logistics response times; decreased repair turn-around-times; and major reductions in awaiting-parts problems.

f. Investigating the delayering of the supply chain.

Summary

The F–35 JPO and its Propulsion PMO continue to expand efforts to identify affordability opportunities and implement cost reduction initiatives. The Propulsion PMO is refining an Affordability Plan with a process to identify and fund sustainment CRIs, which will continually feed the pipeline and assist the Warfighter in achieving expected performance within defined budget constraints.

QUESTIONS SUBMITTED BY MR. MOORE

Mr. MOORE. Does the FY22 budget adequately fund the requirement for expendable countermeasures? Training and combat?

Mr. BROMBERG. This is not relevant to the propulsion system.

Mr. MOORE. Does the FY22 budget adequately fund the requirement for expendable countermeasures? Training and combat?

General FICK. Following the official release of the President's Budget for FY22 last week, DOD and the F–35 Joint Program Office will support congressional engagements and discuss specifics of the FY22 budget request, including the adequacy of funding for expendable training and combat countermeasures. We support the $715 billion Department of Defense budget request. Funding contained in the request aims to advance key DOD priorities to defend the nation, innovate and modernize the Department, build resiliency and readiness, and take care of people.

- Defends the Nation. The discretionary request addresses threats to the Nation by prioritizing the need to counter the pacing threat from China as the Department's top challenge, deterring nation-state threats emanating from Russia, Iran, and North Korea, funding investments in long-range strike capabilities to bolster deterrence and improve survivability, and promoting climate resilience and energy efficiencies.
- Innovates and Modernizes. The discretionary request makes key investments in technology and modernizes the force. The Department will support defense research and development to spur innovation, optimize U.S. Navy shipbuilding, modernize the nuclear deterrent, and invest in hypersonics, artificial intelligence, cybersecurity, microelectronics, and quantum science. In order to prioritize these key investments, the Department will propose to redirect resources to its top priority programs, platforms, and systems by divesting legacy systems with less utility in current and future threat environments.
- Maintains and Enhances Readiness. Our Soldiers, Sailors, Airmen, Marines, and Guardians remain the best trained and equipped force in the world and are always ready to fulfill our most solemn obligation to protect the security of the American people. The discretionary request maintains and enhances readiness

while addressing threats to readiness, including hate group activity within the military, and prioritizing strong protections against harassment and discrimination.

Mr. MOORE. Does the FY22 budget adequately fund the requirement for expendable countermeasures? Training and combat?

General ABBA. Current Air Force inventory and funded procurement will provide sufficient quantities of training and combat expendable countermeasures through at least 2031. The AF will continue to assess requirements based on actual and projected expenditures.

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